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Mack's Road

Forests, Environment and People

Ecological Values and Social Costs

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INDIAN SOCIAL INSTITUTE
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Walter Fernandes

Contents

	Acknowledgements	iii
1	Forests, Environment and People: An Introduction—*Walter Fernandes*	1
2	Forest Management and Forest Policy in India: A Critical Review—*Madhav Gadgil, S. Narendra Prasad and Rauf Ali*	10
3	Forests in the New Forest Policy—*Cecil J. Saldanha*	45
4	The Social and Environmental Impact of Big Dams—*Ravi Chopra*	56
5	Pesticides and the Third World Poor—*David Bull*	75
	References	88
	Index	95

1

Forests, Environment and People: An Introduction

Walter Fernandes

'What price, development?' is the question often asked today when many ill effects of the GNP and productivity oriented development patterns are being experienced. At a time when the technocratic form of development approach was followed, it was assumed that higher investment and productivity would solve social problems such as unemployment and inegalitarian distribution of assets and incomes. It was taken for granted that the social cost that had to be paid in order to improve productivity and GNP was essential for greater good (i.e., development). The socio-political factors were ignored in the process and planning was to a great extent based on 'economism.' Slowly, however, realisation dawned on many planners that

> ultimately, the social and political factors of the society turn out to be more significant than the economic factors. Without a social discipline, lot of funds can go waste without producing proportionate results. Without a political will to help the poor, technically foolproof programmes will fail to achieve their results. Unless the underprivileged groups of the society are freed from the yoke of their exploitation there is hardly any value of political freedom in a democratic set up (Narayan 1979: 45).

Environmental deterioration

Apart from the socio-political consequences of the present development approach more and more are also becoming conscious of the environmental consequences of a strategy that

concentrated only on productivity to the exclusion of other factors. Natural resources which are renewable were often treated as non-renewable. This, for example, has been the case with forests which have been treated by industry primarily as raw materials and by the government as sources of revenue. Little was done to replace the stock that was destroyed (Gadgil 1983: 113-115).

Slowly, environmentalists and others are beginning to realise that human intrusion into the working of nature is possible and necessary but that beyond a certain limit this intrusion causes environmental deterioration. The biological processes are fundamentally cyclical and interaction between a variety of species is essential for the survival of the whole. Any major interference with this variety and interdependence can have deleterious effects on the human life systems. The introduction of monoculture in the forests is only one such interference. The non-degradable synthetic detergents, insecticides and other products introduced with immediate productivity in view have all added to this environmental deterioration (Commoner 1970: 5-11).

Initial reaction to this deterioration came primarily from urban environmentalists many of whom tend to consider preservation of nature an end in itself. The socio-political factors were often forgotten in the process of preserving the natural resources. The Wildife Reserves in India are one such case of man becoming a casualty to the conservation of animals. Many tribals and other forest dwellers belonging to the weaker sections are displaced in order to make place for animals and the green patches required for recreational purposes. Not rarely these conservation projects are based on the assumption that the forests and wildlife need to be preserved from the people (Fernandes 1983: 8-13).

Slowly, however, recognition has dawned on many socially conscious environmentalists that preservation of nature cannot be an end in itself. Many of them realise that

> the environmental issue is more than a question of pollution, in the same way that the development issue is more than a question of short term economic growth. . . . 'Development' means total social development in which the key factors are not primarily economic, but are human and social and are in fact concerned with those basic

> human needs which should be met by the development process and without which the development process is a travesty (Royston 1979: 8).

In other words, the end of all development is to meet the basic human needs of freedom of decision and association, right to clean air, water, food and shelter, education and employment and right to own the means required to meet these needs. Any protection of environment and efforts at productivity need to be judged within the context of the satisfaction of these needs.

It is also being realised that ultimately environmental deterioration is not merely a case of pollution or destruction of nature but that the destruction of nature leads to the deterioration of the status of human beings, especially those belonging to the weaker sections (Agarwal, Chopra and Sharma 1982: 52-54). It is because the weaker sections depend on nature more than the others. As a result, any deterioration of the environment affects them more than the others. This is true in a special way about forests, because the dependence of the forest dwellers, especially those belonging to the weaker sections, is greater than others like the state and the industrialists who depend on the same source. For the industrialists, forests are sources of raw materials, as such a tool for greater profit. For the state, they are a source of higher revenue. For the forest dweller, on the contrary, they are his very life system. As such, he depends on them for his very survival, not merely for profit or higher revenue (D'Abreo 1982: 19-22).

Conversely, environmental deterioration itself is often a result of poverty and inequalities that result in poor housing conditions, unhygienic surroundings, ill health, illiteracy and lack of basic amenities required to preserve the surroundings. The urban slums are only one such example of the surroundings deteriorating because of the lack of basic facilities (Singh and de Souza 1980: 41-48). Deforestation is another case in point. Though even the National Commission on Agriculture states that 'free supply of forest produce to the rural population and their rights and privileges have brought destruction to the forests,' (Government of India 1976: 25) other studies indicate that the real cause of destruction needs to be attributed to poverty, indebtedness and exploitation by

middlemen (Gupta, Banerji and Guleria 1981: 17-25).

Scientific management

These are the issues dealt with by the papers in this monograph. Gadgil, Prasad and Ali argue that because a renewable resource like forests has been treated as a non-renewable resource and has been destroyed without replacing the stock, the tribals who depended on forest produce have been deprived of their means of survival. The deterioration of the environment and the high human cost have been the result of the development pattern that paid attention only to immediate financial benefits and ignored the social and ecological factors. Industry thought primarily in terms of profit and forgot its social responsibility such as jobs and producing quality products that would safeguard the health of the users. The point about quality products is further analysed by David Bull while discussing the impact of pesticides.

Scientific management of forests or of other resources is given as one of the reasons for the present investment pattern that concentrates on productivity as the cost of the social and political factors. It is commonly believed that the British introduced modern scientific management and that the 1952 forest policy confirmed this scientific approach. It is assumed that in order to make forest management scientific, forests have to be protected from the people who destory them through their unscientific practices.

However, as Gadgil *et al.* point out, the British were concerned almost exclusively with the commercial exploitation of forests. With their revenue needs in view, they treated forest as a non-renewable resource meant to be exploited without renewing the stock. The five year plans have, to a great extent, followed the same principle and have looked at forests only as sources of revenue for investment outside the forest areas (Kannan 1983: 77-78).

As Saldanha points out, the 1952 forest policy did give a new perspective and did not think of greater productivity as the only component of scientific management. The policy stated that industrial and revenue needs should be subordinated to environmental and people's needs, especially those of the tribals

and other forest dwellers belonging to the weaker sections.

Despite the policy statement, in its implementation revenue and industrial needs seem to have taken precedence over environmental and people's needs. Chopra discusses some effects of the development approach that has led to environmental degradation and the deterioration of the status of the weaker sections, especially the tribals. David Bull points out the inadequacies of the present policy towards insecticides and other synthetic detergents. In their case, the quick profit motivation of the commercial firms, particularly the multinationals, seems be justified in the name of scientific management of nature and higher growth. The illiterate landless labourers have been the worst victims of the insectides which are often used without proper protection to the user.

What is important to bear in mind is that these ill effects are not merely unforeseen side effects but are essential to the present development approach that thinks primarily in terms of productivity. What Barry Commoner (1970: 14) says about insecticides is probably true about many other aspects of development. Insecticides cause environmental deterioration

> not out of minor inadequacies in the new technologies but because of the very success of these technologies in accomplishing their designed aims. . . . Modern synthetic insecticides kill birds, fish and useful insects just because they are successful in being absorbed by insects and killing them, as they are intended to do.

Briefly, the present forest policy that leads to the deterioration of the environment and of the weaker sections, is in fact one more expression of the development approach that has strengthened those who were already powerful and has further weakened the oppressed.

Need for solutions

Given the seriousness of the situation both from the environmental and socio-political points of view, the writers suggest alternatives to the present system. The first condition for a healthy forest and environmental policy is that while taking decisions concerning investment, one should count the social and ecological benefits, not merely immediate financial

gains. In other words, no aspect, socio-political, environmental, industrial or revenue, can be ignored, but the development of human resources has to get priority over the others.

That this reorientation will have some economic costs is beyond doubt. It is because the technical design that leads to environmental deterioration and human degradation has a sound economic rationale behind it. Thus efforts to reduce environmental deterioration and people's degradation will have some economic costs both in the form of higher investment and lower productivity. However, these economic costs need to be measured against human gains just as today ecological imbalance and human costs are measured against economic gains.

Fear of cooption

To put it in other words, no author suggests total abandoning of all technical inputs but their reorientation to suit people's needs. Bull, for example, does not propagate abandoning of all pesticides but the introduction of Integrated Pest Management (IPM). While suggesting alternatives, the authors are aware that any people-based alternative suggested can be easily coopted by the vested interests.

This is as true about IPM as about other alternatives like solar energy. Technically IPM is a sound people-based solution, since it first uses non-chemical defences against pests and combines them in a healthy way with the chemical pesticides. It is based on a sound knowledge of ecology and lays emphasis on farming and biological control of pests. It propagates control rather than destruction of pests since the environmental and human costs of total annihilation can be high (Bull 1982: 73-77).

However, most IPM research is concentrated in developed countries and is carried out primarily by the multinationals. Most developing countries have done little or no research in this domain and have to depend on the multinationals for what is considered a people-based solution.

> At present IPM actually subserves the interest of pesticide multinationals. The speed with which new pesticides introduced into farms are becoming redundant in the face of mounting pest resistance is of

> great concern to these big manufacturers. It takes about six to ten years of research costing between US $15 to US $20 million to develop a new pesticide plus an additional period of time before it begins to be accepted by farmers. IPM practices help slow down the process of pest resistance. Many companies are now eager to promote IPM so that their pesticides can remain effective for a longer period. Their expenditure on new pesticide development will then come down considerably (Chakravorthy 1982: 4).

Hence, for any alternative to be feasible, one has to begin by tackling the policies of governments in the Third World because often their negligence helps the multinationals to strengthen their hold on the poor and let a few vested interests appropriate to themselves all gain from any new initiatives.

People's participation in the re-forestation programmes is another condition considered indispensable by all authors. However, the writers are careful to see also its shortcomings and know that often the very concept of participation can be coopted by the vested interests. Social forestry is one such solution. Gadgil, for example, speaks of private forests which give higher yield. Thus, purely from the point of view of higher productivity they are to be preferred to the plantations of the forest department in which there is very little participation of the people and survival rate is low. However, the author adds that the highest yield is where there is high participation of the people in the decision-making and implementation process and the trees planted are according to the forest dweller's needs, not those of the industrialists.

In other words, solutions to the present disastrous deforestation cannot be found merely in new reforestation programmes but a new approach to the very concept of forestry and of owership.

> Essential as they are, such forestry measures alone will not be enough to solve the deforestation problem. . . . Many of the underlying sources of deforestation originate outside the scope of forestry per se (Eckholm 1979: 25).

It is clear that people's involvement is essential even purely from a productivity point of view, because the forest department cannot protect forests, especially if it begins with the assumption that they have to be protected from the people. It is with this in view that social forestry is introduced as forestry

with participative management.

However, the forest department remains the 'starting point' also in most social forestry programme. The department would like to extend its role as'an animator, a catalyst, a change agent, co-planner, a co-implementor, co-ordinator and specifically a technical, financial and raw material resource base.' In this process, the department would like to have people's participation in the choice of the species and in protecting trees (Mascarenhas 1982: 66-67).

The people often hesitate to participate in these programmes which do not always originate from them. To take the example of social forestry, though it attempts to 'serve the people not to control land,' in practice the people have apprehensions that the benefits of any community forestry programmes will be cornered by the well-to-do and that the poor will be left only with work. As a result, for any programme to have long-term impact not merely from the productivity but also from the socio-political points of view, the question of land ownership and control of resources needs to be tackled (NIRD 1982: 16-17).

That the weaker sections are apprehensive of appropriation of their labour by the vested interests or a few powerful individuals is confirmed also by other studies. A study of social forestry in the Singhbum district of Bihar, for example, indicated that

> while large farmers are willing to fully participate in the social forestry programme, the landless show the least willingness. This was as expected. The large farmers have surplus barren and waste lands which they would gladly exploit through these social forestry programmes, while the landless have nothing to offer except their labour, and unless the wage rate or social forestry benefits clearly exceed their labour wage rate, they would be unwilling to participate in the social forestry programmes (CFM 1983: 123).

Conclusion

This would mean that, as Gadgil *et al.* state, one has to ensure that industry lives up to its social responsibility. This can never be taken for granted, because as the discussion on social forestry, IPM, solar energy and other programmes has

indicated, the profit-oriented industry would willingly appropriate the fruits of what are considered people-oriented programmes rather than itself invest in any socially beneficial project.

Unless this trend is reversed, forests will continue to be treated as non-renewable resources and the weaker sections will continue to be victims of inequality and of environmental degradation. For the alternatives to be viable, one needs to take a long-term view of issues concerning forests and environment and not limit oneself to short-term profits and revenue. All the existing programmes indicate that no such view is taken. People are, oftener than not, used by the vested interests in the name of participative management.

This trend needs to be reversed and any alternative needs to be rooted in the needs of and decisions by the people. It is not enough to make planting of trees profitable but it should be viewed as such by the people. It is from this point of view that the voluntary afforestation programmes mentioned by Gadgil *et al.* need to be analysed to identify the aspects that led to participation and involvement of the people.

To put it briefly, development can attain its stated goal of serving the people only when environmental deterioration and human degradation are viewed within their proper perspective as the consequence of a purely technocratic approach and the consequent unjust system that marginalises the weaker sections. Any solution has to be geared to reversing this trend and making development people-oriented.

2

Forest Management and Forest Policy in India: A Critical Review

Madhav Gadgil
S. Narendra Prasad
Rauf Ali

This paper is based on a study meant to go into the merits and demerits of the Bastar Pine Plantation project which envisaged clear-felling of 40,000 hectares of deciduous forest dominated by sal to raise plantations of tropical pine as raw material for a paper industry. It appeared to us that the issue being raised had wider implications and that it would be desirable not only to go into the environmental consequences of this particular project of raising man-made forests on a large scale. We therefore requested and obtained full support from the office of the Inspector General of Forests to examine the experience of such plantation programmes in different parts of the country. This investigation was conducted over a period of 12 months beginning June 1981.

A large number of persons have cooperated in this study, prominent among them being Shri M.K. Dalvi, Retd. Inspector General of Forests and Chairman of the Committee for which this study was undertaken, the chief conservator of forests and other officials of Karnataka, officials of West Coast Paper Mills. We received financial support from the Department of Environment. World Wildlife Fund-India, Karnataka State Council of Science and Technology and University Grants Commission. We express our gratitude to all of them. We also thank the voluntary organisations for the cooperation we received in the study.

This study of plantations was preceded by an earlier 5-year study of the bamboo resources of Karnataka State taken up at the instance of the State Government (Prasad and Gadgil 1981: 340). This study primarily pertained to the management of stocks in natural forests harvested on a system analogous to selection felling. We also investigated in some depth the experience of three voluntary agencies engaged in programmes of afforestation in 1981-82.

Besides these investigations of production forestry, we have looked at the protective and nature conservation functions of the forests in a number of contexts since 1973. We have also been involved in studies of the environmental impact of river valley projects, particularly on forests in the catchment areas for several years (Gadgil 1979; Sharma and Sharma 1981: 340).

The present paper summarises the new material accumulated during these investigations, and reviews the other available material. After reviewing the functions of the country's forest cover and the extent to which these functions are being served today, we shall present a review of the current practices and consequences of forest management. We will then go on to analyse the social causes of the current difficulties, develop the rationale for a fresh approach to the management of our forest resources and outline an alternative forest policy that flows from this approach.

I. FUNCTIONS OF FOREST COVER

That forests serve many valuable functions has been well known for a long time and has been reflected in both the National Forest Policy of 1952 and the Forest Conservation Act 1980. The major functions may be broadly grouped in four categories: as storehouses of living organisms of potential use, as regulators of rainfall, soil and water regime, as sources of many basic needs of the weaker sections of the rural population and as the mines of many industrial raw materials. This is of course in addition to a variety of aesthetic, moral and ethical considerations.

Biological potential

A most significant function of forests without doubt is the fact that they serve as storehouses of biological diversity. A systematic study of various plant types found in natural forests is expected to yield (i) *New food plants* such as cereals, roots and tubers, vegetables and fruits (Anon 1975: 189). (ii) *New medicinal plants:* tropical forests especially evergreen forests, have high concentrations of alkaloids, tannins, protease inhibitors and other chemicals of potential pharmaceutical value in their leaves, bark and fruit. A study of tribal medicine in the Attapadi valley of Kerala showed that the tribals used the roots of 39 different species, fruits of 15 species, leaves of 30 species, stems and bark of 12 species each, latex and flowers of 2 species each and 9 species of entire plants, for different medicinal purposes, including treatment of fever, cuts, burns, pain and skin diseases (KFRI 1980: 235). The study team also discovered abortifants and antifertility preparations being used by the tribals in Kerala and in Bastar. Most of the preparations used here are unknown to modern medicine, and it is likely that a detailed analysis will produce new drugs of significant value, in the same way as *Rauwolfia serpentina* was discovered by modern medicine a couple of decades ago. (iii) Forest plants are also potential sources of new types of gums, resins, scents, colourants and pesticides (Anon 1980: 81) and provide alternate sources of hydro-carbons for fuel (Khoshoo 1982). (iv) India's forests are rich in wild relatives of cultivated plants ranging from *ragi* and wild rice through pepper and cardamom to mango. These wild relatives are valuable reservoirs of genes vital for continuing productivity of our crops, especially for resistance to new varieties of diseases and pests (Pal 1981).

We have as yet hardly begun to tap these resources. As things stand, every hectare of forest that is lost to cultivation, river valley projects, and conversion to plantations without being surveyed in detail means the risk of loss of one or more potentially valuable species forever.

Regulation of soil and water

It is a widely held popular belief that forests enhance rain-

fall. While the data on this score are equivocal due to statistical problems of discerning the influence of deforestation, recent numerical studies indicate that deforestation may indeed lead to reduced rainfall through change in soil moisture and albedo (Charney et al. 1977). What is quite well substantiated is that forest cover reduces soil erosion and regulates floods by reducing surface run-off. Compared to the evergreen forest, soil erosion is 20 times greater in cardamom plantations, 130 times greater in grassland and an astounding 3250 greater under annual crops (Puri 1960). We know that the Ganges now carries so much silt from the deforested Himalayas that new islands like the New Moore Island have started forming in the Bay of Bengal. There is abundant evidence of increase of floods due to deforestation (Ghosh and Rao 1979).

Benefits to tribal and rural economy

Man has depended on the natural living resources from his forest environment for all his basic needs for all but a fraction of his evolutionary history. While the majority in the industrialised countries is no longer dependent on the natural living resources in this fashion, the bulk of the rural and a section of the urban population in India and the rest of the developing world continues this dependence, especially for their fuel needs. The forests also serve as sources of construction material like bamboo and fodder for the livestock for large fractions of the population. Finally forests are the home for a majority of the original inhabitants of the country, the tribals, who constitute some 7 per cent of the nation's population.

Industrial raw material

Finally, the forests have been and are increasingly becoming more important as sources of industrial raw material. Though timber has been used from ancient times, forest produce gained considerable commercial importance only after the British started laying an extensive network of railway lines using wooden sleepers. Today forest produce support a

number of major and minor industries such as saw mills, paper, plywood, polyfibres, match, turpentine, tannins and many drugs.

II. CURRENT STATUS

From India's total land area of 305 million ha for which statistics are available, about 21 million ha are in the high reaches of the Himalayas or Rann of Kutch i.e., a natural desert which could never bear any plant growth. Another 18 million ha are under human settlements and industry. A total of 266 million ha of our land surface is then devoted to biological production as farmland, pastures or forests. Of these 143 million ha are under cultivation, about 75 million ha are classified as forests, 8m ha as permanent pastures, 17m ha as culturable wastes and 23m ha as fallow.

However, while 83m ha may be classified as forests and permanent pastures, less than half of them namely 35m ha are actually under tree or grass cover. The remaining 48m ha plus 17m ha of culturable wastes and 23m ha of fallow, i.e., fully 88m ha are more or less completely unproductive. In addition, another 87m ha of agricultural land suffer from serious soil erosion, and at least 10m ha from water logging and salinity (Vohra 1980). A good part of this agricultural land thus suffering is then marginal for agriculture and better put under tree crops. While no definite figures are available, one can hazard a guess that this is so for at least one-third out of these 97m ha, so that the total land surface of the country needing to be afforested must be put at 120m ha out of a relevant area of 266m ha, or fully 45 per cent.

Biological diversity

Besides even in the 35m ha that are under tree cover the stocking, productivity and natural diversity are far from satisfactory. A recent compilation by the Forest Survey of India (1982: 37) reveals that perhaps less than 6m ha out of these retain their primary character and therefore their complement of the original biological wealth of plant and animal species. Furthermore, an analysis of our forests by vegetation types

shows that a number of vegetation types, particularly of the dry tracts, have totally disappeared, while even with the better preserved evergreen forest types only about 10 to 30 per cent retains its primary character (see Appendix) (Gadgil and Meher-Homji 1982: 24).

With only about 2 per cent of the world's land surface, India possesses 5 per cent of the known species of plants and animals. The total number of these, at a conservative estimate, must be around 1.25 lakhs. Modern ecological theory predicts that given the current state of reduction of our natural biological communities we are likely to lose as many as 85,000 of these species in the coming centuries (Gadgil and Meher-Homji, in press). While admittedly a crude estimate, this figure points to the serious dangers facing us.

Soil and water conservation

The loss of our forest cover has very serious implications for the conservation of our soils and water. It has been said that one of our country's most precious exports is its topsoil. Of course, not all of this leaves the country: much gets accumulated in reservoirs and river beds. The actual rates of erosion in our reservoirs are on an average 2.3 times greater than those predicted; so that the storage capacity of Nizamsagar was reduced by 63 per cent in 44 years, of Mayurakshi by 10 per cent in 20 years and Panchet by 12 per cent in 19 years. At the same time, the area of land affected by annual floods today stands at around 40m ha as against 25m ha 30 years ago. The economic costs of these are enormous; a sum of Rs 3180 crores was spent on just flood control in India between 1976-78 (Vohra 1980).

Tribal and rural economy

The enormous potential of forests for contributing to an uplift of our rural economy should be viewed in the context of the grinding poverty and the country's dual society with the top ten per cent getting most of the benefits of development.

The gravest problem facing the rural poor is that of lack of productive employment. As Dr M. S. Swaminathan (1982: 102)

remarked, famines in India are not famines of food but of work. There are some 90 million jobless people in India with more than 7 million additional people entering the job market every year. Unfortunately, the pattern of industrialisation adopted by us absorbs barely 5 lakh of these new entrants leaving more than 6.5 million yearly to add to the already enormous pool of unemployed.

As we will explore further, the only possible solution to this famine of work can come from land and water based jobs, which even today employ six times as many people as are employed in industry, trade and government together. Unfortunately, the depletion of our forest resources is now contributing to further destruction of employment and standards of living of the rural poor. Bhatt (1981: 108) has documented that the depletion of bamboo stocks of Tamilnadu has reduced the earnings of basket-weavers from Rs 8 per day in the early 1970s to less than Rs 6 per day now. Furthermore, presently these basket-weavers are always under threat of sudden periods of unemployment of several weeks due to unavailability of bamboos: a situation they had never known till a decade ago.

Apart from such actual loss of employment, the rural populations have suffered considerable lowering of standards of living due to the much greater difficulty in obtaining their basic requirements such as fuel and fodder. Gavlis, a pastoral buffalo-keeping tribe of Western Ghats had to considerably reduce the number of animals they could maintain, and even switch from buffaloes to cattle and goat due to the deterioration of fodder resources following deforestation and soil erosion (Gadgil and Malhotra 1982).

Industrial raw materials

As George (1982) puts it, the country is already experiencing a shortage, not just of fuelwood but of industrial wood as well, a shortage, which could become a timber famine within a few years. As a result of depletion of bamboo resources, which we shall discuss later, capacity utilisation by the paper industries which was consistently around 90 per cent from 1951-70 is now down to 70 per cent (*Commerce:* 8th August

1981). Many smaller industries such as wooden toys, plywood, match and polyfibre are similarly facing serious problems.

The very evident continuing depletion of our forest resources and the increasing difficulties faced by our rural population and industries suggest that our forest cover is now quite incapable of meeting the demands imposed on it. While this is universally agreed upon, there is an inadequate data base to ascertain the precise extent to which our forests are unable to meet the demands imposed upon them and therefore undergoing a depletion of their capital stocks. The estimates for forest area in 1970-71 range from 74.8m ha according to the Central Forestry Commission to 66m ha according to the agricultural statistics (Govt of India, 1976). This report also does not clarify how much of this area was actually under tree cover, although the Dhebar Commission Report (1961) on Scheduled Tribes and Areas had already commented pointedly on treeless forests. This is only now being worked out, especially because of the availability of the landsat imagery. We therefore have to work on the arbitrary figure of 35 million ha under actual tree cover (Vohra 1980). No reliable estimate of the growing stock of these resources is available, various estimates placing it at 1100 to 2600 million cubic metres (George 1982).

The next parameter of interest is the annual increment or rate of growth variously estimated at 16 to 70 million cubic metres, which should work out to 6.4 to 30 million tonnes (George 1982). This suggests a very low productivity indeed of much less than 1 tonne/ha/year. As Seth, Kaul and Sharma (1972) point out, this implies that only about 4 per cent of the potential productivity of our forests is actually realised. This agrees with a field study of our own in a very good rainfall area of Supa in Uttara Kannada district which showed an annual above-ground production of only 0.8 tonnes/ha while the potential for such an area is easily between 15-20 tonnes/ha/year.

Be that as it may, we must inquire as to how this annual production of 16 to 70 million cubic metres compares with the demand. The official volume of extraction from our forests is around 10 million cubic metres of industrial wood and 16m

cubic metres of fuel wood (see Table 1). Assuming an average of 50 per cent removal of wood from trees cut, the total official harvest comes to 50 million cubic metres, much above the lower though below the upper estimate of annual production. However, this leaves out totally the very substantial unrecorded extraction, especially for fuelwood, whose total demand in the country is today around 200 million cubic metres. For Gujarat, its Chief Conservator, Shri Karamchandani (1982: 32), estimates that of the total 6.07 million tonnes of fuelwood consumed in 1978, 0.16m tonnes was recorded and 1.03m tonnes were unrecorded removals from the forest, the remaining 80 per cent coming from agricultural lands, waste lands, etc. If we extrapolate this relation of recorded to unrecorded removal to the country as a whole, it suggests that over 106 million cubic metres of firewood are extracted from our forests. Adding to this the industrial wood, the total annual extraction of wood from our forests comes to 126 million cubic metres, well above even the upper estimates of 70 million cubic metres as annual increment to the standing stock.

Table 1

Aggregate raw material requirement for 1980, under assumptions of high and low income growth (in thousand cubic metres)

Item	Coniferous Wood		Hard Wood		Total Wood	
	High	Low	High	Low	High	Low
Sawn wood	2,020	1,890	12,080	11,255	14,100	13,145
Fanel products:						
Plywood and veneer	120	105	480	415	600	520
Fibreboard	20	15	75	70	95	85
Pulp and paper	1,100	965	3,075	2,710	4,175	3,675
Matchwood			535	535	535	535
Round wood	1,480	1,410	5,910	5,635	7,390	7,045
Total	4,740	4,385	22,155	20,620	26,895	25,005

When the harvest from a renewable resource like forest exceeds the increment, we begin to eat into the capital stock itself. As the capital stock declines, the problems of over-exploitation become all the more severe and the rate of depletion of the capital stock goes on accelerating. Our forest stocks today are unfortunately in this state, and our forest

managers find themselves in the unenviable position of managing such a fast depleting resource. We shall now turn to an examination of how our forests are actually faring under these difficult conditions.

III. FOREST MANAGEMENT

Historical development

The climax vegetation of most of our subcontinent except in the higher reaches of the Himalayas and portions of the desert is some type of forest or other, and trees must once have covered almost all of our country. Large scale introduction of agriculture affected tree cover where the terrain was plain and water supply dependable as in the Gangetic plains. However, most of the hilly, dry and malarious tracts like the Terais appeared to have remained under a good forest cover till the arrival of the British.

In great contrast to this apparent health of India's forest cover barring the land actually under cultivation was the near complete deforestation of England by the time the British established their Indian Empire. It is also well known that the British had totally deforested the Eastern United States and South Africa over the 18th and 19th century. It is therefore quite wrong to believe that it was the British who introduced the notion of rational management of forests to India which were earlier being ruthlessly destroyed by its own inhabitants (Sagreiya 1967: 239)

On consolidating their hold over India, the British began to lay down an extensive network of railway lines to facilitate the export of raw materials from and the import of finished goods to the remote corners of the country. Often these lines were deliberately routed through the richest areas, as for instance the diversion via Londa between Dharwar and Belgaum in Karnataka to tap the forest resources.

There are, however, a few exceptions, particularly when the unreserved forest was directly under the control of a cohesive village community, and not under the control of revenue authorities. Thus there are many *Vanpanchayat* forests in the Tehri-Garhwal areas of the Himalayas which

are fully controlled by the local community and are better preserved than the reserve forests of the tract. Furthermore, the reserve forests themselves have not escaped considerable and often total depletion. In our fieldwork in the Mulshi, Velhe and Maval taluks of Pune district of Maharashtra we have come across large areas which on record are well stocked reserve forests, but on ground are totally barren. In the Bangalore division itself, excessive demand for fuelwood has led to exhaustion of fuelwood stocks in six out of seven ranges (Chetty 1976: 345).

As matters stand today most of the tree cover is on government reserve forests. In fact, the Government legislation has tended to disfavour maintenance of tree cover on private land because of the policy of nationalisation of such land.

Thus extensive forest tracts owned by private tea and coffee estates on the Western Ghats were converted to tea or coffee by the owners in the last few years, because they would otherwise have been taken over by the Government. The fores department itself promptly liquidates the tree cover while handing over land to other agencies, even its own Forest Industries Corporation. Thus in Karnataka several hundred hectares were so deforested near Balekoppa in Uttara Kannada district for setting up a grass farm. Only a fraction of this area is utilised to this date, while the top-soil is being washed away in this region of high rainfall over a large tract of now barren land.

Rationale of management

On reservation of forests, the British introduced a modern system of forest management which was termed scientific. However, this is a misnomer for the essence of science is its grounding in empirical facts. Such an empirical basis is by and large quite lacking in our forest management. As examples we may note that as mentioned above, there is no firm information on aspects such as the land under the control of forest department, standing crop, productivity, the removal of firewood, etc.

While even this level of information is not properly available, scientific management of forests requires much more

detailed information on the dynamics of the forest ecosystem. Consider, as an example, the working of tropical evergreen forests of Karnataka. These are prescribed to be exploited at the rate of ten trees per hectare every 35 to 40 years on the assumption that this would guarantee adequate regeneration and sustainable use. But Rai (1982) has pointed out that several effects have been neglected in drawing these prescriptions and that as a result these forests are definitely deteriorating and in need of complete rest from all exploitation. The main point to stress is that the plans thus developed cannot be considered scientific, as they are based on guesses only even though they are prepared in a very systematic fashion. Besides the main bias of the forest policy was and still remains urban and industrial as can be noted in its implementation.

Wildlife conservation

Though there had been considerable reduction of wildlife over thickly populated areas when the British consolidated their hold, India was a hunter's paradise. This wildlife population began to be eliminated by hunters. In fact *shikar* was part of the British status symbol. Thus the Asiatic lion was hunted out in its entire range till it was saved in the lion sanctuary of Gir by the Nawab of Junagadh (Seshadri 1969: 212). By the time of independence wildlife largely survived in such preserves or in a few till then inaccessible tracts such as Silent Valley or Agastyamalai on the Western Ghats.

Wildlife conservation was seriously taken up only after independence, but its focus was the same as that of the hunting preserves of the Maharajas, namely, the conservation of a few game species like the tiger and rhinoceros. In fact many royal hunting preserves like Bandipur, Bharatpur, Simlipal and Ranthambor became modern wildlife sanctuaries. While a notable advance, this approach had a serious flaw in that it did not appreciate the value of preservation of biological diversity as a whole. Therefore, there have been no systematic attempts to protect the entire variety of the country's plant and animal life at all.

Apart from the narrow focus on a few species, our conservation effort also suffers from lack of commitment of many officials posted to the job. Furthermore, ringed as they

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are by masses of poverty-stricken populations, these nature reserves offer great attraction to the people to make a living.

Thus, a large number of families in the village of Hangla on the border of Bandipur Tiger Reserve have no way of making a living except cutting fuelwood from the fringes of the Tiger Reserve and selling it in the market. Others take to poaching, and in the Periyar Tiger Reserve today the poachers hold such complete sway in the core area that hardly a tusker is left in the elephant population there. The Joint Director of Botanical Survey of India was held captive by the poachers at gunpoint when his party visited the area for scientific studies.

Soil and water conservation

There is no clear policy relating to preservation of a minimum forest cover specifically for soil and water conservation at least on the slopes in geologically sensitive terrain or in catchments of water courses. It was only following the disastrous Alakananda floods of 1970 which took a heavy toll of human lives and property that these problems really came to the fore. An official enquiry committee later implicated excessive fellings in the geologically sensitive areas on steep slopes and the landslides that triggered off the floods, and all fellings in an area of Alakananda catchment were halted. But even now there is inadequate scientific information available on the vital issue of the relation between deforestation and landslides in the Himalayas, and decisions on fellings to be taken up in these regions are being based merely on political pressures and counterpressures.

There is also no systematic attempt at preserving the vegetation cover in the catchments of any of our river valley projects. On the contrary, these projects, by rendering the area accessible, often result in its rapid deforestation as documented by Gadgil (1981) for several cases on the Western Ghats.

Production forestry

The vast bulk of the forests of the country, except for the National Park, Project Tiger Reserves and a few inaccessible forests totalling around 9 lakh hectares or 1.2 per cent of the area under forest department control, is worked for productive purposes (Forest Survey of India 1982: 37). This working

of a renewable resource could be either to use it sustainably by harvesting just the increment, or by attempting to enhance its productivity through the introduction of fast growing or economically more valuable species. The former leads to various forms of selection fellings and the latter to plantation programmes.

The bulk of our forests are managed on the selection felling basis. Unfortunately, due to a variety of reasons such as lack of an adequate data base, failure to take proper account of rural demands, violation of prescriptions by commercial interests and excessive grazing and regular forest fires, this system does not lead to sustained yields as expected.

We will consider here only one example, namely that of bamboo resources of Karnataka and Tamilnadu (Prasad and Gadgil 1981; Bhatt 1981: 68). This plant of tremendous utility to the rural population was proscribed as a weed to be eradicated in the early working plans. It, however, assumed industrial importance with its use as raw material for paper beginning 1919. Initially, it was considered unlimited and made available practically free at rates like Re 1 per tonne to the industry. However, over the last couple of decades the projected supplies have failed to materialise. The West Coast Paper Mill in Karnataka, for example, realised only 40 thousand tonnes as against the expected supply of 150 thousand and has to go as far as Arunachal Pradesh to meet its raw material requirements. The paper mills are also violating silvicultural regulations in their attempts to meet their needs and worsening the situation in the process (Prasad and Gadgil 1981).

Apart from their failure to meet the objective of sustained yields, there are other problems, both environmental and social, with this type of working. To take but one example, the plywood and match industries have exhausted most of the high statured trees from Karnataka's evergreen forests. This has led to the disappearance of a critical resource to many animal species—for instance safe nesting sites for the hornbills and hive building sites for the rock bees (Bhatt 1982: 19). The depletion of rock bee-hives has had a significant effect on the local population for which collection of their honey was an important source of livelihood in certain seasons of

the year.

Teak plantations replacing the so-called miscellaneous forests have predominated the efforts at enhancing the economic productivity of the forests from early British times. Now the plantations are taken up with certain projected growth and survival of the selected species. While the programme is justified on the basis of these projections, there is little attempt to later evaluate whether the actual performance comes to the level of that expected.

Since no such published information was available, we undertook fresh fieldwork in several parts of the country to arrive at an estimate. Available data for 25 Forest Ranges of the Karantaka circle show that actual yield varies from 14 to 41 per cent of the projected yield, the average being 33 per cent of the expectation. Less detailed observations on teak plantations of Madhya Pradesh and Maharashtra show the same trends.

What this means is that apart from the fact that no thought was given to rural requirements of fuel, bamboo, etc. This situation persisted till the rapid growth of paper, plywood, polyfibre, matchwood and such forest based industries particularly after and the subsequent shortage of raw materials. Eucalyptus was found particularly suitable to fill the gap since these industries required soft wood and it is quick growing and immune from grazing by animals. So large-scale eucalyptus plantations were launched beginning in the 1950s (Chaturvedi 1976). The yields expected from these plantations were in the range of 7.4 to 14.8 tonnes per ha on an average on poor sites (Kaikini 1967).

Our study for six years in six ranges of Haliyal Division—a region with good rainfall—showed yields ranging from 0.86 to 2.22 tonnes/ha/year with an average of 1.4 tonnes/ha/year i.e., 10 per cent of the projected yield. The yields in Bangalore (a dry area) are 20 per cent of the projected yield. This is good record for eucalyptus plantations which were also taken up on a large scale by clear-felling excellent rain forests in many high rainfall tracts of the Western Ghats. These were everywhere attacked by a fungal disease known as pink disease wiping out extensive plantations whose productivity was then zero, and which merely served as an exercise to

convert tracts of excellent rain forest into man-made deserts. Perhaps the best example of this is in the Parambikulam tracts of Kerala. The eucalyptus plantations of South Bastar were also largely total failures, with a survival rate of around 1 per cent.

Other species were planted in the Himalayas with one or more of the following: ash, deodar, cypress, chir, kail, walnut and horse chestnut. In the Badrinath Division, the percentage of survival of the plantation is an average of 14.2 per cent. In Garhwal survival averaged 21.5 per cent and in Kedarnath Division around 20 per cent.

Reasons enumerated for this failure include wrong selection of planting sites and species, improper seed collection, incorrect nursery and plantation techniques, improper supervision of the plantation programme and widespread grazing by domestic livestock even in plantations fenced by barbed wire.

Whatever the cause, these plantation programmes have had serious environmental and social implications. Whenever a plantation is taken up, it destroys at a stroke many resources on which the local population depends and thereby often raises strong feelings of resentment. Dhareshwar (1941) documents the protests of the rural population of Uttara Kannada when teak plantations were first taken up in this area, and these protests continue to this date, now often against the eucalyptus plantations. The tribals of the Central Indian forest belt have often objected to replacement of *sal* forest by teak and other plantations and in fact the destruction of teak plantations in Singbhum has been part of the programme of the militant Jharkhand movement.

When plantations are taken up, it is desirable to maintain belts of natural forests in between. This is often not done, not even along the water courses. Thus no such belts have been left along Tambraparni river in Mundunthurai Widlife Sanctuary or near Kozhikamathi in Annamalai Sanctuary of Tamilnadu or along the Satyamangalam-Dimbam road in Chamarajnagar Forest Division of Karnataka.

The plantations are based on a very narrow choice of species. With our narrow choice we run serious risks of the plantations being wiped out by diseases. This, for instance, has happened with the pink disease which has led to large scale

failures of eucalyptus plantations in the high rainfall tracts of Westen Ghats. In some tracts the pink disease has led to total wiping out of the eucalyptus plantations converting the area which was once tropical evergreen forest to barren wasteland, for instance in the Parambikulam tracts of Kerala.

Finally, one may ask whether even those Plantations which have not failed have enhanced the productivity of the land. In order to answer this we can compare the productivity of the eucalyptus plantations of Uttara Kannada with that of the natural forest. This can be done on the basis of Viswanathan's (1972) data on the growth of non-teak species in plots clear-felled for raising teak plantation. He records an average volume per tree of 0.894 cubic metre at an age of 55 years with densities of about 400 trees per hectare. Hence, the annual increment is 6.5 M^3/ha or 2.8 tonnes/ha. This is twice as great as the average eucalyptus yields of Haliyal Division of 1.4 tonnes/ha/year and comparable to the eucalyptus yields of Yellapur Division of 3 tonnes/ha/year. The plantations, even of quick growing species, then are not an improvement over the low productivity of natural forests.

Social forestry

By the 1950s the fuelwood crisis of the rural population was becoming increasingly acute and its significance in the very low productivity of our natural forests and plantations was becoming clear. The forest departments therefore began for the first time to consider these needs of the rural population and attempt to involve their cooperation in the raising of plantations. Out of this developed the social forestry programmes.

The early social forestry programme of the Tamilnadu Government was called farm forestry (Anonymous 1964: 46). It involved the raising of fuelwood plantations on tank bunds and other common land. While the plantations were to be raised by the forest department, they were guarded by a local villager whose job depended on the success of the plantations. Secondly, the village *panchayat* was to receive half the revenue on maturation of the crop. However, the blocks established of 40 ha per watchman were too large and

the investment in the planting programmes inadequate. As a result, the productivity of these farm forestry programmes is still low, with an average of 1.15 tonnes/ha/yr and 0.8 tonnes/ha/year for *Acacia nilotica* plantations of Madurai and Tirunelveli districts respectively. Furthermore, the wood produced is not made available to the rural poor, rather it is being cornered by the urban consumers.

By the 1970s the forest based industry in Karnataka which began to experience difficulties in satisfying its raw material requirements turned to private farmers and offered them remunerative prices. Thus, Harihar Polyfibre in Karnataka began to buy eucalyptus from farmers at Rs 300 per tonne since the supplies from Government at Rs 120 per tonne were inadequate. The farmers in drought affected areas like Bangalore, Kolar and Tumkur found it advantageous to shift to tree crops, mostly eucalyptus, since these are less affected by vagaries of the monsoon and require lower labour inputs.

The experience reveals a remarkable contrast between the cost incurred and the production achieved for the Government plantations and plantations on private farms. Our survey of these districts shows that the government spends Rs 2000 per hectare to achieve yields of under 2 tonnes/hectare/year while the farmer spends a mere Rs 500-1000 per hectare to achieve yields of over 10 tonnes/ha/year. Moreover, the overheads by the Government in maintaining the infrastructure are not included in the cost of Rs 2000 per hectare. A similar picture emerges in Tamilnadu (Shetty 1982).

Gujarat, with only about 5 per cent of its area under effective forest cover and famous for its enterprising businessmen and farmers, has launched the most innovative social forestry programme of all (Karamchandani 1982). There were several components to this programme such as strip plantations along roadsides, canal banks and railway lines with village *panchayats* promised 50 per cent of the net profits on maturity. By 1981, some 2000 village woodlots have been created covering 17,000 hectares. The lots are raised at Government expense, but the *panchayat* will receive 50 per cent of net profits on maturity.

This highly imaginative programme involves landless families in the planting and protecting operations in a manner

that ensures them both a regular income and a share in the net profit from the harvest. Each family is assigned 37.5 ha of degraded forest to be planted at the rate of 2.5 ha/year over a period of 15 years. Each family is committed to provide 40 mandays of work a month and in return is paid a fixed monthly remuneration of Rs 250, housing material free of charge, minor forest produce and 20 per cent of the net profit from the harvest at the end of 15 years.

The innovative programme encourages farmers to put degraded and marginal farmland under tree crops by furnishing free seedlings and an additional subsistence allowance of Rs 250 per year, provided that the survival is above 70 per cent. A modification of this programme has been applied to the tribal tract in the Dangs.

By 1980, 605 farmers had taken to planting eucalyptus and obtained yields of well over 20 tonnes/ha/year on irrigated land replacing cotton, leading to net annual profit of Rs 6,000 to Rs 10,000 per hectare.

Non-Governmental organisations

The Gujarat experiment of assigning degraded forest land to private individuals for raising plantations is a pointer to a possible solution of our twin problems of unproductive lands and unemployed people. Three non-governmental agencies have also successfully addressed themselves to the challenge of rendering productive barren lands and proven that this is feasible.

At Alakanada in the Himalayas Shri Chandiprasad Bhatt of the Dasholi Gram Swarajya Mandal has motivated villagers to take up afforestation of totally barren land, often with landslides on it (Kunwar 1982: 102). The success of these plantations with real participation by people has been good with survival exceeding 70 to 90 per cent as compared to 20 to 50 per cent in Government plantations of the same region.

At Auroville near Pondicherry a group of volunteers was settled on some 2000 acres of degraded land. The volunteers soon discovered that this land was unfit for cultivation and was best put under tree crops. They have therefore conducted serious experiments in afforestation of this land coupled with

soil and water conservation measures, employing a round-the-clock watchman, developing a live fence and irrigating where possible. Their inputs are therefore substantial, of the order of Rs 5000- 6000 per hectare, but the experiment has been successful and the tree crop is now doing well and can be shown to be a profitable investment in monetary terms alone, apart from the other ecological benefits. Current indications are that the yield will be between 6 to 20 tonnes/ha/year depending on the quality of the soil.

The third experiment is that by the Bhagavatulu Charitable Trust in Vishakapatnam District of Andhra Pradesh. Here the attempt has been to develop a balanced combination of tree crops, animal husbandry and agriculture on barren, hilly tracts in a very low rainfall area. The attempt was found to be clearly viable.

It cannot be gainsaid that the tree cover of the country, its natural wealth of living organisms and even its very mantle of soil is in great difficulties. The land and the forest has had its productive capacity profoundly depressed by the pressuse being put on it, so that we are today realising only a fraction of what it is capable of producing. The biological diversity is on the way to near total annihilation in the coming decades.

It can, however, be argued that the problems are man-made and could be solved if only society could gear itself to tackling them. It is therefore appropriate at this stage to analyse the social forces that are behind what is happening to our forests, soil and nature.

IV. SOCIAL FORCES

Three segments of our society are intimately concerned with what is happening to our forests, namely, the rural poor, industry and the Government machinery. Unfortunately, the self-interest of none of these sectors are served by a proper maintenance of the tree cover (Sharma 1978: 25). The rural poor can at best derive very low wages by working as forest labourers or by selling firewood, and since they do not share in the profits made from the forest produce these wages always remain low at the subsistence level. Thus while the industrial labour of the West Coast Paper Mills earns Rs 20 or more per

day with facilities such as leave, job security, housing and medical care, the bamboo extraction labour working under far more difficult conditions earns just Rs 7 per day. Further, their wages do not change whether the bamboo stocks go up or down and hence they have no stake in its preservation.

While the rural poor gain little by protecting the tree crop, they have always been so far able to establish their ownership over a patch of land by cutting down the trees and putting it to the plough. This is why as many as 2.5 million ha of forest land has been lost to cultivation between 1951 and 1976 (see Table 2).

Table 2

The loss of forest area for various purposes between 1951-1976

Purpose	Area (thousand ha)
River valley projects	479.1
Agricultural purposes	2506.9
Construction of roads	57.1
Establishment of Industries	127.2
Miscellaneous purpose	965.4

Source: Pillai (1981).

The industry and timber merchants gain nothing at least in the short run, by preserving the forest stock. Instead they can maximise immediate profit by concentrating on minimising the present cost of resources. This is what they do, and in the process often resort to violations of forestry regulations. Furthermore, they have been given little incentive for investing in the preservation of resources. The very low prices, well below replacement cost, at which they had access to resources meant that they had no motivation to invest substantially in resource regeneration. They also had no land of their own on which to attempt this. Of course, in recent years when cheap resources from the Government are drying up they have turned to helping the private farmers grow the resources by providing them a remunerative price and facilities such as loans. But by and large the industry has so far concentrated only on exploiting newer and newer species in more remote areas as the currently used resources have been exhausted one by one.

Our whole bureaucratic apparatus with diffusion of responsibility and lack of any accountability provides no motivation to a good officer for proper management of resources under his charge, nor disincentives for those who mismanage. As a consequence, there is little commitment on the part of the bureaucracy towards good husbanding of the resources they are in charge of.

Human beings rarely act in any but self-interest and we must therefore so direct social forces that individuals will gain by working towards the social good. The social good in this case is the proper maintenance of the productivity and diversity of our living resources.

One force that we can harness towards this is the immense unemployed labour force of the rural poor (Ranganathan 1979: 34). Obviously, if only we can wean this human resource away from the presently destructive activities that they have been forced into by poverty, and towards a constructive task, much could be accomplished, and the present tide of degradation turned around.

V. A NEW APPROACH

Not a revenue generating sector

It would be fruitful at this juncture to take an entirely fresh look at how we may manage our forest resources in light of the considerations mentioned above. One may approach this question from three different angles, namely conservation, enhancing production and more efficient use. The forest cover is providing services such as water conservation and amelioration of the climate which cannot be measured in monetary terms. Forests are also providing much needed inputs to the rural sector in the form of fuelwood, construction material, fodder etc., which do not appear as revenue to the state. It is nevertheless a real economic benefit to the society as a whole.

We should therefore cease treating the forestry sector primarily as a revenue generating sector for, if we do so, and if for instance, the Planning Commission urges the states to raise resources anyhow, there is a temptation to raise these by

E-100
861

liquidating the capital assets of the standing forest crops.

This also has been a serious constraint on the functioning of forest development corporations. These corporations have been forced to raise capital by clearfelling forests, a process that has had many undesirable consequences.

There is however no escaping the fact that we cannot conserve our forest cover without substantially enhancing the production of the forestry sector. The demands of the rural, urban and industrial sectors on forest produce will undoubtedly go on increasing in future, further worsening the current deficits. Unless we can solve this problem by substantially stepping up our production, the shortfall will inevitably be made up by further eating into the standing capital of the forest stock.

Tree production

What then is the best strategy for stepping up our production from the forestry sector? There are two related questions involved: the type of land we should employ to enhance the production, and the nature of the agency entrusted with this task. As Table 3 shows, there are a large number of alternatives before us: The land to be used for enhancing tree production could be land with a good standing crop of trees, degraded forest land, waste land under government control, waste land communally owned by a village, marginal farm land owned by individual farmers, or good farm land owned individually.

The agency involved could be the forest department, other Government departments, private industry, cooperatives of tribals, landless labourers or farmers or individual tribals. The merits of the programme will have to be judged on five criteria, namely, (a) the investment required, (b) the level of productivity likely to be achieved, (c) the kinds of social conflicts that may ensue, (d) the level of employment likely to be generated, and (e) impact on biological diversity, land and water resources.

Clearfelling

Perhaps, the main option currently favoured for stepping

Tabls 3

The relative merit/demerit of using different kinds of land and different agencies for enhancing tree production. The merit or demerit is indicated for the following five points of view: (a) investment required; (b) probable level of productivity; (c) likely social conflicts; (d) employment generation; (e) environmental consequences. + denotes desirable; o neutral; and — undesirable.

Agency	Government department					Industry					Co-operative					Individual				
Land	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Good miscellaneous forest	+	−	−	−	−	+	+	−	+	−	+	+	+	+	−	+	+	+	+	−
Degraded forest	−	−	o	+	+	+	+	−	+	+	+	+	+	+	+	+	+	+	+	+
Government or communally owned wasteland	−	−	o	+	+	+	+	−	+	+	+	+	+	+	+	+	+	+	+	+
Individually owned barren land or marignal farmland	−	−	−	+	+	+	+	−	+	+	+	+	−	+	+	+	+	+	+	+
Good farmland	+	−	−	−	o	+	+	−	−	o	+	+	−	−	o	+	+	−	−	o

up forest production is the replacement of good forest by plantation of fast growing species. The rationale is that tracts of miscellaneous forests of slow growing uneconomic species are best converted to plantations of fast growing species by agencies such as forest development corporations, to step up production.

The results of our investigations mentioned above clearly indicate that the primary aim of stepping up production is not being realised: that given the constraints on the government machinery, the cost of such programmes is much higher than for say, a farmer; that these programmes have not generated any large scale year round employment; and that they have led to serious social conflicts in many places where the taking up of the plantation has led to the destruction of vital fuel, fodder and other resources to the local population.

Furthermore, the area of land with a good standing cover of trees has very much shrunk in our country and is now no more than 10 per cent of the land. Again, as was documented above, many such plantations replacing good forest have failed and further added to the barren land which now covers a third of the country's relevant surface. It is therefore clearly undesirable on all counts to continue the present practice of clearfelling a good standing crop of forests to raise new plantations, whether it is practised by the goverment, industry or individuals.

Private individuals and in particular the landless, are encroaching on good forests to bring the land under cultivation. This is either traditional as with the shifting cultivation system of the tribals in the North-East or because of the absence of alternative means of subsistence as with the tribals of Central India engaged in movements like 'Jabaran Jot.' In all these cases the viable alternative is to provide these people with other means of making a living. Thus creation of rural employment will necessarily have to be a prerequisite of successfully stepping up forest production.

Degraded forest land

The second class of land which may be considered in terms of stepping up forest productivity is land under forest

department control but with a degraded forest cover. The extent of such land appears to equal if not exceed the extent of land with good forest cover.

The cost of bringing such land under a successful tree crop is likely to be greater and its productivity likely to be lower than when a good forest is clearfelled and brought under plantation. It is however important to note that what is relevant is not just the productivity of the new plantation raised on such land but the enhancement of the total productivity of our land due to this plantation.

Should we grow luxury timber?

Productivity may be defined in economic rather than biological terms. Since a timber like teak fetches exceedingly high prices, a teak plantation could always be argued to improve economic productivity of that land. An important point to consider here is that teak does not fulfil any irreplaceable function. Its price is already sufficiently high so that metal, hardboard or chipboard provide equally desirable functional alternatives. The value of teak is therefore primarily as a luxury timber which now only the rich can afford. The real functional material that may be produced on the same land to replace teak will then be wood that can be converted into chip-board or fuel which may supply energy for processing metals. It is these that should receive primacy of consideration.

Developing wastelands

We may then further explore the possibility of tree production on degraded forest land, waste land under revenue or other control and marginal farm land. We have an abundance of such land considerably in excess of good forest land. The experiences of voluntary agencies mentioned above have demonstrated that it is possible to render such land productive. However, to do so would require considerable labour input and long term intensive care. While the Government machinery is not geared to provide such care, the private individuals are able to do so. A large proportion of our population is in fact squeezing out small yields of cereal grains of

a few quintals per hectare by culivating such land with considerable effort. These and many other rural people similarly placed would be willing to put such poor land under tree crops provided that they can economically afford to do so. For the moment, they cannot do so and instead cultivate cereal crops only because the cereal crops provide quick yields while tree-planting is a long-term investment which few can afford.

Some progressive social forestry measures in Gujarat attempt to do just this. They include the provisions for a salary for 10 or 15 years, provided they carry out a certain defined quantum of work in terms of planting and protection of the tree crop, and a share in the profit derived from the tree crop on its maturity.

Such a programme will make it possible for the farmers to wait for the period of time required for the tree crop to mature, which is the main difficulty today in the way of the rural population taking seriously to the cultivation of tree crops. Such a programme would also minimise social conflict for any land that would be alienated from local people for uses such as grazing will be handed over to many of the same population for tree farming. Finally, this programme has the potential of generating employment for the rural population on a very large scale and is therefore highly desirable. This programme is also highly desirable from an environmental viewpoint.

The land envisaged to be put under tree crops with this programme ranges from individually owned marginal farm land, through village goacher or grazing land, communally owned tribal tracts, and revenue forest areas to degraded tracts of reserve forest. The organisation of the local society may again range from a well knit tribal society of some states in the Northeast, to landless labour belonging to oppressed castes in states like Bihar. The precise pattern of the organisation of tree farming will therefore have to be flexibly adapted to the local conditions if such a programme is to be implemented successfully.

Another major option to be considered for tree production would be to assign barren or degraded areas to specific industries for generating their own raw materials. As mentioned

above, the present practice of subsidising raw materials gives no incentive to industries to replace the forests. But we have also shown that they are capable of doing it when required.

Such a programme would however require very large tracts of land to be handed over to these industries if they were to grow their own raw material. Given the present adverse land to man ratio in India there are no large tracts of land which are currently not being used by the rural population to meet its own needs of fuel, fodder and so on. If the industries are given control over such lands they will naturally tend to close these for rural use. This could lead to serious social conflicts as happened with the West Coast Paper Mills when it tried to fence off large parts of its concessional areas to protect the bamboo crop. The industries may also tend to go in for capital intensive technologies for tree production and thereby reduce the potential for employment generation. These problems may however be surmounted by insisting that the industry generate a certain quantum of fuel and fodder on part of the land leased to it for industrial wood production, and also guarantee a certain minimal level of employment to the local population.

The last option is the production of tree crops by farmers on good farm land. Since because of wood famine the industries began to purchase soft wood such as eucalyptus which is at Rs 300 or more per tonne, growing eucalyptus (or other crops such as casurina) became profitable to farmers. As a result, cultivation of tree crops has been taken up both under rainfed conditions and under irrigation. The increasing switch over to such crops in areas such as Karnataka and Gujarat proves their economic viability. Such a shift however, reduces rural employment and may also lead to conflicts. The Tamil Nadu Government in fact, has been contemplating banning such tree crop cultivation on this ground.

Generation of rural employment

As Table 4 shows, therefore, the best option for stepping up tree production would appear to be through cooperatives or individuals from the weaker segments of the rural population on degraded forest land and marginal farm land. As

mentioned earlier there must be as many as 120 million hectares available for tree production through such a programme. The quantum of land assigned to each family will have to be worked out on the basis of the quality of land and the structure of the local society. Depending on the choice the programme will generate jobs for between 3 to 120 million families. It is only the generation of employment on such a scale that can make a dent in our grave problem of rural unemployment.

The programme would also call for investment of the order of Rs 1000 per hectare per year for these 100 or more million hectares. The investment will take between 5 and 15 years to yield dividends. One may, however, expect from such a programme yields of the order of 5 tonnes per hectare per year after the initial gestation period. If we can add to our economy this tree production of the order of 500 million tonnes per year, it would make a tremendous impact on the nation as a whole.

Efficient resource use

Only such massive enhancement of tree production can take away the pressures from the existing forests and make their conservation possible. At the same time we have to seriously explore more efficient use of our forest resources to reduce the level of demand. Firstly, we can altogether give up non-essential uses. Thus wood need not be used for railway sleepers which are already being manufactured from concrete on a large scale. Secondly, we can improve the quality of products such as plywood so that their increased life significantly reduces the demand (George 1982). Government policies everywhere should provide incentives to the industrial sector for more efficient use of wood products.

The other major use of wood is as fuel. There is a tremendous scope for reducing fuelwood requirements by propagation of more efficient *chulas* and alternative fuel such as biogas. City sewage could be tapped to generate biogas on a large scale to meet urban fuel requirements. Massive investment in such programmes would be entirely justified.

Finally, industry today has not been motivated to make

efficient and sustainable use of its resources. The picture will change the moment industry is supplied raw material at the replacement cost and thereby motivated to induce its production. This would best be achieved through a Central excise with the generated revenue being returned to the states.

A change in the attitude of the industry is already apparent and the rayon industry in Karnataka is offering farmers loans and other facilities to generate the raw material. This development is also welcome in that it is beginning to bring some benefits of the forest based industry to the rural population. Otherwise, the only way in which the rural population benefits from the industry is through the very poor wages paid to the forest labourers. One might in fact explore in the future the possibility of forest labourers and tree farmers actually being given shares in forest based industries.

Another major resource supplied today by the forest areas is fodder for the livestock. As of today large tracts of our forest areas are heavily overgrazed with consequent low productivity. An important component of improving the efficiency of the use of forest resources will have to be more rational management of the livestock. The only long term solution is to reduce the livestock population in a phased manner by slow genetic upgrading and switchover to stall feeding.

Even after pressure on forests is reduced by enhancing production and inducing more efficient use, and by finding alternate energy resources, the local population near the forest areas will continue to depend on the forest for many of their basic requirements. Their pressure would be best regulated by making them partners in forest management. Once the industrial pressure is taken away from the forest areas they would basically be dedicated to meeting the local requirements. It should then be possible to get their full cooperation in rational management of the forests by evolving some mechanism for their participation.

There can be no two opinions about the desirability of protecting the forest wealth from excessive and illegal exploitation. However, one must distinguish between this kind of loot by commercial interests and the harvest of forest produce by the rural population which has traditionally depended on these resources. Many of them have no alternative to grazing

in the forest area, cutting of firewood or cultivating a patch of marginal forest land to derive a subsistence. While the approach to the illicit activities of the commercial interests should be to deter them with the strong force of law, the approach of the subsistence activities of the rural population should be to provide them with alternative avenues of employment.

There should also be stronger legal provisions for penalizing the erring officials and politicians who may be involved in illicit exploitation of forest wealth. Today there is no proper mechanism for an ordinary citizen who detects such involvement to bring the culprit to book. One must seriously think of developing a system on the model of *lokpals* or ombudsmen to whom appeal can be made by the citizens against erring officials.

Conclusion

The rationale that has guided our nature conservation effort needs considerable reorientation. We now understand conservation as an effort to preserve the overall biological diversity of the country. We must therefore identify nature reserves to represent each of the biological community types of India over an area sufficiently large to maintain the community on a long term basis. This approach immediately implies a considerable change from the current approach of wildlife sanctuaries where extensive destruction of the original biological community is permitted to continue through practices such as clearfelling and extensive selection felling.

The present approach towards protection of the Wildlife Sanctuaries and National Parks is through the force of arms. This again has to be changed and the cooperation of the local population must instead be obtained by vigorously developing programmes of employment generation such as tree farming around the nature reserves.

While developing such a forest policy it is necessary for us to mould the policies to local circumstances. Thus the conditions prevalent in tribal areas, such as Mizoram, would be quite different from those prevalent in the Garhwal Himalayas dominated by farmers and shepherds of the semi-arid tracts of the Deccan Plateau where the forest has disappeared quite

some time ago.

The National Forest Policy enunciated in 1952 advocates maintenance of fully one-third of the geographical area of our country under forest cover. Efforts need to be made to reach this level of vegetation. But while working for this growth of tree cover, the criteria of ecological balance, supporting the rural economy, reducing rural unemployment and industrial raw materials have to be borne in mind. Ultimately, one needs to remember that forests can be preserved only through people's participation and by creating in every sector of the population a vested interest in afforestation as against the present situation that encourages deforestation.

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Appendix

Present Status of different vegetation types of India

	Vegetation type	Potential area (in thousand hectares)	Percentage remaining close to climax	Percentage remaining under other physiognomies
I.	*Wet evergreen forests of West-Coast-Western Ghats*			
(1)	Cullenis-Mesua Pallaquium	2150	18	30
(2)	Dipterocarpus, Mesua, Pallaquium	2250	9.5	51.8
(3)	Persea-Holigarna-Diospyros	1075	28.8	60
(4)	Montane shola	356	7.9	34 6
(5)	Memecylon-Syzygium-Actionodaphne	675	11.9	25
(6)	Bridelia-Syzygium-Terminalia-Ficus	275	41	77
II.	*Wet evergreen-Teak ecotone*			
(1)	Tectona-Lagorstroemia-Dillenia-Terminaria-Paniculata	4975	17.5	24.9
(2)	Tectona-Terminalia-Adina-Anogeissus	1625	26.6	33.2
III.	*Teak zone*			
(1)	Anogeissus-Terminalia-Tectona	36090	4.7	18.4
(2)	Tectons-Terminalis	17250	15.4	45
IV.	*Teak-Sal Transition zone*			
(1)	Terminalia-Anogeissus-latifolia	11975	5.5	16.3
(2)	Terminalia-Anogeissus-Cleistanthus	10375	8.1	27.9
V.	*Sal zone*			
(1)	Shorea-Buchanania-Cleistanthus	8375	13.5	38.5
(2)	Shorea-Cleistanthus-Croton	10750	6.8	13.9
(3)	Shorea-Buchanania-Terminalia	100	15	90
(4)	Shorea-Terminalia-Adina	19510	37.1	47.0
(5)	Shorea-Dillenia-Pterospermum	1875	5.9	9.0
(6)	Shorea-Syzygium operculate-Toona	3950	24.5	86.3
(7)	Toona-Garuga	1000	17.2	17.2

VI.	*Hardwickia zone*			
(1)	Hardwickia binata-Albizzia amara	12125	11.8	12.5
VII.	*Albizzia amara zone*			
(1)	Albizzia amara-Acacia	15350	4.9	5.6
(2)	Anogeissus latifolia-Chloroxylon-Albizzia amara	2725	0.4	0.6
(3)	Manilkara-Chloroxylon	2750	0.2	4.8
VIII.	*Anogeissus pendula zone*			
(1)	Acacia senegal-Anogeissus pendula	3460	1.2	4.3
(2)	Acacia catechu-Anogeissus pendula	15805	7.8	10.6
(3)	Anogeissus pendula-Anogeissus latifolis	5000	2.41	5.1
IX.	*Deccan thorn forest*			
(1)	Acacia-Anogeissus latifolia	9780	0	0.27
X.	*Deccan-Indian desert*			
(1)	Acacia-Capparis	17250	0	0
XI.	*Indian Desert*			
(1)	Prosopis-Capparis-Ziziphus-salvadora-Calligonum	30875	0	0
XII.	*West Himalayas*			
(1)	Subtropical evergreen sclerophylloas forest	1340	—	23.3
(2)	Alpine steppe	5600	—	4.1
XIII.	*Himalayas*			
(1)	Subtropical pinus roxburghii	4900	—	19.2
(2)	Temperate mixed oak and confierous forest	2360	—	54.6
(3)	Temperate coniferous forest	912	—	13.6
(4)	Subalpine forest	5076	—	3.8
(5)	Alpine scrup	512	—	9.4
XIV.	*Eastern Himalayas—Northeastern India*			
(1)	Tropical wet evergreen forest	5860	—	14.7
(2)	Tropical moist deciduous forest	5472	—	32.6

(3)	Subtropical broad leaved hill forest	300	—	49.3
(4)	Montane wet temperate forest	2828	—	6.4
XV.	*Andaman and Nicobar Islands*			
(1)	Tropical wet evergreen forest	684	80	80
XVI.	*Coastal*			
(1)	Mangrove	550	—	—

3

Forests in the New Forest Policy

Cecil J. Saldanha

There exists a paradoxical situation in Indian Forestry involving planning and execution. The National Forest Policy of 1952 recommended that at least a third of the geographical area of the country should be clothed with forests—60 per cent in the hilly tracts and 20 per cent in the plains. Unfortunately, 30 years after the enunciation of the policy, India has barely 23 per cent of its area under forest cover, too often of a degraded type. Not only has there been no increase in area, but even a considerable diminution. 4.5 million hectares of forest land have been alienated for non-forest use between 1952 and 1979 (Bachetki 1981: iii). The immediate socio-economic consequences of such a trend are being felt by the common man—rural and urban—as well as by forest-based industries. The long-term threat to life-supporting systems, to the quality of our air, fertility of our soil and management of our water is becoming tangible if not ominous.

The New Forest Policy

Aware of this threat the Government of India has initiated a review of the situation and through its Central Board of Forestry is drafting new guidelines for a fresh 'Forest Policy.' The Board has first tried to identify the lacunae in the 'National Forest Policy' of 1952. Next, it has listed needs and established priorities (Govt. of India 1982). It is gratifying to note that while sustained and increased forest productivity is

earnestly sought after, it is considered consequent and subordinate to environmental stability and ecological security especially on labile mountain slopes and strategic catchment areas. Emphasis is laid on the need to reclaim denuded desertic and littoral regions degraded by long and improper use. In the utilisation of forest produce the needs of the tribals and rural poor are to be preferentially catered to against the compelling claims of the organised industrial sector. Attempts to conserve our heritage of biological diversity, both plant and animal, have gained importance. The desire to involve the public in safeguarding and enhancing our forest wealth is another refreshing aspect of the new approach. In short, the Central Board of Forestry has tried to keep in mind the multiple functions of a forest and to balance its various uses in a comprehensive and rational manner.

Effective implementation: hurdles and strategies

If this new forest policy has to be translated into enlightened and effective action, a proper analysis of the many parameters of forest management have to be kept in mind, the hurdles to implementation identified and appropriate strategies initiated. The intricacies of Centre-State relationships were partly responsible for the failure of the earlier forest policy (Govt. of India 1976). Nationalised forests are managed by State Forest Departments according to State regulations and often under local pressure. It was only in 1976 that forests were placed in the concurrent list by the forty-second Amendment to the Constitution. The Forest Conservation Act 1981 requires the prior permission of the Centre for alienation of any forest-land to non-forest use. Uniformity in inter-State policies and price-structure is likewise requisite for the success of the new policy. Karnataka recently tried to introduce a realistic price structure for forest produce supplied to industry (Government of Karnataka, Notification FFD 100 FDP 80 dated 19th February 1981) only to find itself involved in litigation and to see the industries patronising suppliers offering lower rates in other States. The unauthorised possession of Sandal *(Santalum album L.)* is an offence in Karnataka. Poachers generally smuggle it across the borders into States

where no such legislation exists.

The varying forms of land tenure and use, socio-economic ethos of tribals and forest-dependants, the imperatives of accelerated economic growth and the dangers of over-exploitation are also some other aspects that need to be considered in any worthwhile action programme. Above all, an appreciation of forest ecosystems, their role in environmental equilibrium and their potential for sustained productivity are basic to any utilisation policy. There can be no forest policy unless we understand and preserve our forests.

Forest type

The role of forests varies with forest types. Some are predominantly protective, others productive either commercially or for the daily needs of the common man. A national policy in a country stretching from the snows of the Himalayas to the sands of Kanyakumari has to take into account a diversity of forest forms and utilise each according to its function and potential.

There are three main forest types in India:

Tropical wet forests
Tropical dry forests
Montane forests

Each has northern and southern variants, climax types and degradation patterns as shown by Champion and Seth (1968).

The northern montane forests of the Himalayas are of needle-leaved conifers like Chir *(Pinus roxburghii)* and Deodar *(Cedrus deodara)* or broad-leaved species like Oak and Rhododendron. Luxuriant trees once covered the mountain slopes with their protective mantle. Without fully appreciating the role of these forests in the ecology of the hills, intensive exploitation often through forest contractors was undertaken. The loss of the protective tree cover coupled with the geological instability of the range has resulted in heavy erosion and land slides. A short drive from Nainital towards Bhowali in the Kumaon is enough to confront a visitor with the tragedy that stalks this beautiful land. Entire mountain sides are

crumbling carrying away houses, trees and tons of soil. The silt has made the river beds incapable of containing the accelerated run-off from rain and melting snow. Alternating floods and drought have become annual. Consequently large sums have to be spent in flood relief and similar amounts in drought relief.

The gravity of the problem is of such Himalayan proportions that even the common men and women of the hills have risen in protest against the depredation of their homes and habitat. The *Chipko Andolan* has become a byword in people's movements (Roy Burman 1979: 23).

A similar situation is in the making in the mountains of peninsular India, especially on the Western Ghats range that runs from Surat to Kanyakumari. The forests of this range could be placed in three broad categories, all of the southern tropical wet type. The first, termed Tropical Evergreen, clothes the lower valleys and precipitous slopes on the western windward side especially in the southern reaches of the range. The second category is the Moist Deciduous, generally occurring on the leeward side. The third group is the Southern Montane Forest or shola type occurring in compact patches above 1,500 m (Subramanyan and Nayar 1974: 180 ff.).

Case study of Tropical Evergreens: a complex ecosystem

An analysis of only the first type will help illustrate the nature and function of the forests and the pressures on it. The Tropical Evergreens on the Ghats form a rich but fragile ecosystem biologically productive and ecologically protective. They are nurtured by the heavy seasonal rains of the south-west monsoons. The massive buttressed trunks of the canopy trees have verdant crowns that fan out high above the ground to form a veritable roof. The composition of the canopy may vary depending on slope, soil, altitude, duration of the dry season and amount of precipitation. The Saldhupa *(Vateria indica)* so common in Karnataka and Kerala is scarcely seen in Goa and Maharashtra. Likewise the *Cullenia-Palaquium* association occurs only in Kerala.

Beneath the natural roof of the canopy temperature, wind-velocity, light intensity and relative humidity change rapidly.

Through a long process of selection, different plants have found their own optima for metabolic activities especially for photosynthetic autotropism. This results in a horizontal stratification in the undisturbed forest. The red-flowered Myrtle *(Syzygium laetum)* is a typical example of a tree that has found its own particular niche in the forests. At a lower level within the forest are numerous shrubs that thrive in subdued light. Among them the drug plants *Costus speciosus* and *Rauwolfia serpentina*.

A number of woody twiners spiral to the sun supported by the canopy trees. They try to utilise the brightness near the forest roof with an economy of supporting systems. *Moullava spicata* and *Gnetum ula* are exclusive or endangered representatives of these climbers.

Epiphytes that cling to the giants of the forest for support but can produce their own food, form another group of plants in the forest. Several lichens, mosses, ferns and flowering plants are epiphytic. A leafless orchid, *Chilochista*, could illustrate the marvels of biological adaptability in this group. Away from the soil, devoid of leaves, this orchid grows, flowers and fruits by ingenious devices. High above the ground it clings to its support by adhesive roots. A layer of specialised root tissue condenses atmospheric moisture in mist and cloud as a substitute for ground water. Leafless, it juggles water, air and light into nourishing carbohydrates using the green chloroplasts permeating the outer cells of its roots. Fertilisation through cross-pollination is encouraged by sticky pollen-masses carried from flower to flower by visiting insects. Its dust-like seeds are wafted by the wind to neighbouring branches in fair weather only, to germinate there helped by symbiotic fungi.

The canopy and understorey trees, the shrubs, climbers and epiphytes have thus the capacity to utilise particular levels of solar energy for the efficient conversion of water and carbon-dioxide into organic foods. During this process not only is the lethal carbon-dioxide absorbed but the life-sustaining oxygen is emitted in a seemingly effortless fashion to maintain the atmospheric balance.

The plants are essentially producers of food. However, when autotropism fails, holoparasitism may take over as in

the Indian Pipe Plant *(Aeginetia indica)* which bears only flowers and sustains itself by absorbing both water and nutrients from the roots of its host.

The productive plant system in the forest sustains a series of animal consumers from tiny insects to massive pachyderms. The secondary consumers ranging from ticks to amphibia, reptiles and the larger feline carnivores feed on the other animals in the forest. The extent of the forest and the relative sizes of each population are crucial for the food pyramids. That a rare monkey or a regal tiger can survive in the forests is a clear indication of a rich and functioning ecosystem.

This ecosystem has its own inbuilt recycling process and conservation capabilities. The forest debris is broken down into simpler chemicals by decomposers consisting of fungi, bacteria and other macro as well as micro-organisms. The end-product is a nutrient humus which, besides enriching the soil, helps in its conservation by preventing a rapid run-off during the heavy rains and by gradually filtering the surface water into the streams and rivulets to feed the river systems of peninsular India.

Utilisation

Timber

The tropical forests of the Western Ghats have attracted a good deal of exploitation. Regular selection fellings have been carried on by the Forest Departments for both fuel and timber. Illicit felling, especially by marauding groups from across State borders is quite well known. Adkoli (1980) reports the organised plunder of Kodagu forests by poachers from Kerala. Similarly Prasad (1982) recounts how a group of about 223 poachers from Tamilnadu, some of them armed with firearms, threatened Dr. Vohra, Chairman of the National Committee of Environmental Planning and the other members of his party within the Periyar Game Sanctuary in Kerala. Pillai (1981; 3: 26) estimates that illicit removal from forest areas could be equal to if not more than, the regular recorded production. As a result of these activities the giants of forest decimated by axe and saw, have come crashing down leaving

gaping holes in the canopy. This has meant the death not only of the tree but also of many delicate plants that could survive only in the controlled conditions beneath the closed canopy. The liana that reached for the sky, the herb that hugged the ground, the orchid that perched on the tree and the mushroom that erupted in the dark can scarcely survive after the drastic change in light, humidity and seclusion. Where clear-felling has been resorted to, in addition to loss of plant forms, irreversible degradation in soil conditions can occur due to heavy run-off accompanied by massive erosion of the precious humus. Laterisation of the tropical soil leaves barren patches where once there used to be a cover of lush green. It is in the context of this destruction that the Chief Conservator of Forests in Karnataka posed the question whether it would not henceforth be desirable to opt for complete closure of the evergreen forests from exploitation (Shyam Sundar, Deshmukh et al. (1981; 4: 115).

Commercial crops

The warm wet slopes of the Western Ghats have proved suitable for plantation of lucrative commercial crops. These have caused an alarming shrinkage of the pristine forest cover. Cocoa and Cardamom are grown under a closed canopy which in most cases is of the original trees. The natural understoreys are completely eliminated and the forest floor replanted with the beverage and spice plants. Unless there is a proper programme to replace the canopy trees with suitable native species the tree cover could disappear or be replaced by exotic monocultures. For coffee, the forest canopy is opened and the original tree species often replaced by a few exotics like the Silver Oak *(Grevillea robusta)*. Except in tiny refuges the native plants and the animals that depend on them are on the road to extinction.

Mining

The Western Ghats have rich deposits of bauxite, haematite, manganese and magnesite. As these are surface deposits open-cast mining becomes profitable. Miners in Goa and Karnataka have bulldozed grassy meadows studded with carpets of exquisite flowers into unsightly gashes and mounds of

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rubble. In Uttara Kannada district of Karnataka manganese mines are worked in the depths of the evergreen forests to the detriment of both aerial and underground systems. The threat of further destruction of forest and meadow increases as fresh deposits of non-renewable ores are discovered. The blast of dynamite and the rumble of earth-movers may soon rend the air around Kodachadri and Bababudangiri in the same State.

Hydel Projects

Inroads into the Western Ghats forests have also been made by giant hydel projects. The narrow valleys with swift rivers swollen by the heavy monsoon present a promising potential of hydel power. The generation of this power becomes all the more significant in those areas where there are no deposits of fossil fuels like coal and oil. Since the rainfall is seasonal a constant head has to be obtained by impounding the monsoon flushes in vast reservoirs behind towering dams. In Kerala alone there are nine hydel projects with an overall installed capacity of 1011.5 MW and annual energy production of 4030 MU. Eight other projects are in the pipe-line awaiting clearance from the Centre. These would have an installed capacity of 1480 MW and an annual energy output of 4346 MU (Pillai 1981; 1: 29). While the State Electricity Board is eager to tap these additional resources, the Planning Commission has called for detailed Environmental Impact Studies before giving the required clearance. A decision on the 'Silent Valley' project is being eagerly awaited both by the Kerala Electricity Board and by those concerned with the protection of a rich forest type (Biswas 1981). The Linganamakki Dam on the Sharavathi River in Karnataka resulted in the loss of vast acres of prime forest land in Shimoga District. In the Uttara Kannada District 14,449 hectares of forest have already been lost to hydel projects. Another 13,304 hectares will be lost if the Gangavali Stages I & II as well as Kalinadi Stages II & III are taken up. Further losses will occur if the Sharavathi Tail Race and Agnashini Projects are implemented. Thus a single district stands to lose over 40,000 hectares of forest if the hydel potential of the region is to be utilised (Saldanha 1982).

It was the reaction of the common people of Uttara Kannada that slowed the headlong rush towards high dams and made the State government to call for an in-depth study of the functions and use of forest and river valley in a complex environmental set-up (Sharma and Sharma 1981).

The complex nature of environmental management wherein development and utilisation have to be combined with protection and conservation may be apparent in this brief analysis of just one type of forest.

What is true of the Tropical Evergreens is, with variations applicable to other forest types. Biological diversity suffers when the variety of natural deciduous forests is replaced by the monotony of monocultures or the limited life-forms of forest plantations. The Bastar Pine Plantation project which envisaged clear-felling of 40,000 hectares of deciduous sal *(Shorea robusta)* forests to raise pine plantations for paper mills under a World Bank scheme is being reassessed after the cause of the tribals and forest dependants was taken up by the intelligentsia (Gadgil et al. 1982: 1; Agarwal et al. 1982: 47; Shiva and Bandyopadhyay 1981: 116).

Compensatory afforestisation

The loss of the forest cover due to developmental projects has to be made up by compensatory afforestisation, especially in the catchment areas of reservoirs and in river valleys. This will not only serve to increase our forest resources but also prevent silting of the reservoirs. The Government of India not only stipulated compensatory afforestisation before clearing the Kalinadi Stage II hydel project but also required that the cost of this planting should be built into the financial structure of the project (DST/No. 3/24/78-HCT/Env. dated 16/8/1979). A sum of Rs 20 lakhs was recently transferred from the Karnataka Power Corporation to the Forest Department to expedite this work. Doubts are however being raised about the success of these efforts. Speaking of Karnataka only, Adkoli (1981) has shown that at the present pace of planting it will take 80-90 years to cover the total area available in the State. Even more alarming is the fact that due to heavy incursions by both man and cattle the success of these afforestisation programmes is limited to only 3-4 years.

Need for domestic fuel

The decrease in forest area due to the conversion of forest land to non-forest uses is leading India to a serious fuel crisis. The demand for fuelwood, the most important source of domestic energy in the country, has grown faster than supply. Against a calculated annual requirement of about 133 million tonnes of fuelwood all present and projected plans will help produce only about 49 million tonnes. Consequently the pressure on the natural forests is increasing. The common man has to go further and further to pick the faggots that will cook his food and warm his home.

Alternate sources of renewable energy have to be stepped up. At the same time plantations of fast growing species especially suited to particular climates and soils are essential. The Central Land Resource Conservation and Development Commission and the State Land Use Boards will have to identify areas suitable for fuelwood plantations. It is estimated that about 20 million hectares of land comprising wastelands, degraded forests, roadsides and canal sides may be available for planting fuelwood. Plantations of over 1.5 million hectares a year are considered imperative. Involvement of government and non-government agencies, of *Van Vigyan Kendras*, *Panchayats* and educational institutions is needed in the massive effort calling for an estimated outlay of Rs. 800 to Rs. 1000 crores (cf. *Report of the Fuelwood Study Committee, 1982*).

It is possibly the attitude to forests, that denies them an intrinsic right to land and relegates them by sufferance to residual land not required for any purpose, that sustains the paradox in forestry. Whenever a need arises vast areas of forest are encroached upon, de-forested and converted to non-forest use.

Conclusion

The serious problem in Indian forestry can be overcome only by a united national effort. The State Forest Departments as the official guardians of 95 per cent of this wealth should go in not only for extensive but also intensive silviculture. Just as we have evolved better crop plants in agriculture so also we need better trees in forestry. Import of suitable

trees as gene pool material, cloning, hybridisation and plant breeding are working wonders in many parts of the world. The efforts made at the Forest Research Institute, Dehra Dun and elsewhere need to be effectively transferred to the field.

Much is said for and against the privileges of forest dwellers. On the one hand, abuse of age-old privileges has caused quite an amount of damage (Shyam Sundar 1981). On the other hand, eviction of these forest-dependants from their traditional habitat has led to a good deal of displacement and oppression (D'Abreo 1982: 20-22). Positive efforts to create an atmosphere where it becomes worthwhile to plant and preserve rather than to cut and sell is possibly the beginning of any 'New Forest Policy.'

4

The Social and Environmental Impact of Big Dams

Ravi Chopra

In this century, India ranks among the more important dam building nations in the world. Soon after independence, multi-purpose river valley projects and other dams came to be regarded as essential for meeting the country's critical requirements of irrigation for agriculture, electricity for industries and flood control. Dam building has been pursued at an accelerating pace in the last three decades. In 25 years, from 1954 to 1979, the installed hydroelectric energy generating capacity rose 12 times, from 3.24 billion kilowatt-hours (kwh) to 39.4 billion kwh. The irrigation potential created by major and medium size projects increased from 9.7 million hectares in 1950-51 to 26.6 million hectares in 1979-80 (Planning Commission 1981: 147-166). Irrigation is the single most important factor in our achieving a fair measure of self-sufficiency in food production.

Despite these impressive achievements, the expected benefits, in terms of the actual generation of electricity, irrigation and flood control, have fallen short of the planned targets. If the costs of environmental degradation, such as deforestation

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in the catchment areas, are included, the price paid for these modern temples becomes truly staggering.

Review of benefits

Irrigation

Between 1951 and 1980, the Indian Government spent Rs 7510 crores on major and medium surface irrigation works. This resulted in an additional irrigation potential of 17 million hectares, according to the Sixth Plan document (Table 1). The actual area irrigated, however, is much less, due to delays in constructing field channels and water routes.

Table 1

Outlay on development of irrigation potential

	Outlay expenditure (million rupees)		Cumulative irrigation potential (mha)	
	Major & medium irrgn	Minor irrgn	Major & medium irrgn	Minor irrgn
Pre-Plan benefits	—	—	9.70	12.90
First Plan	3800*	760	12.20	14.06
Second Plan	3800	1420	14.30	14.79
Third Plan	5810	3280	16.60	17.01
Annual Plan 1966-69	4340	3260	18.10	19.00
Fourth Plan 1969-74	12370 (a)	5130	20.70	23.50
Fifth Plan 1974-78	24420 (b)	6310	24.82	27.30
Annual Plan 1978-79	9770	2370	25.86	28.60
Annual Plan 1979-80	10790	2600	26.60	30.00
	75100	25130		

Note : *Inclusive of Rs 800 million incurred during the pre-Plan period.

(a) Excludes Plan outlay in unapproved Kaveri basin projects.

(b) Excludes non-Plan outlay on unapproved Kaveri basin projects.

Figures for minor irrigation pertain to governmental outlays only.

Source: Sixth Five Year Plan (1980-85). Planning Commission, Government of India.

The Planning Commission has admitted, in the Sixth Plan document, that the huge investments made in irrigation have yielded disappointingly low returns in terms of yield as well as finance. While irrigated land should annually yield at least four to five tonnes of grain per hectare, the national average for such fields is only about 1.7 tonnes per hectare.

The development of irrigation in the different states has been lopsided. Punjab, Tamil Nadu, Haryana, Rajasthan and Uttar Pradesh have the highest percentage of cultivated land under irrigation. On the other hand, in spite of having the maximum number of dams in the country, only 41 per cent of Maharashtra's cultivated area is irrigated (CMIE 1981: Table 4.8).

Use of surface water for irrigation has proved to be costly. The Planning Commission's figures show that an average investment of over Rs 2800 was required to create one hectare of irrigation potential by major and medium irrigation schemes. On the other hand, for ground water irrigation systems, the corresponding figure is only about Rs 840.

Hydroelectric power

Though the installed capacity for generating hydroelectric energy had increased to over 41 million kwh in 1980, it represented mereiy 10 per cent of the nation's potential as assessed by the Cental Electricity Authority in 1978. Its contribution to the total energy consumed in India is small, less than 7 per cent in 1975-76.

Besides being a renewable and non-polluting source of energy, hydropower is supposed to be cheaper than thermal or nuclear power. Persistent delays in commissioning hydroelectric projects, however, have escalated generating costs beyond those of nuclear and thermal power plants.

The benefits of the massive investment in hydroelectric projects have gone mainly to the urban areas. This is because the industrial sector is the largest user of electrical energy in India. The corresponding share of agriculture, though rising steadily since 1954, stood at a meagre 14.2 per cent in 1978-79 (Prasad 1979). During periods of peak demand or low power production, for example in summer, electric supply to rural areas is frequently bypassed in favour of urban areas. Many

farmers keep a diesel pump as a back-up. On the industrial front too, the rate of growth of power generation has not matched the growth of demand for electricity.

Transmission and distribution losses due to inadequate investment and implementation, further reduce the benefits available from the installed capacity. The national average of 20 per cent is almost double that of most of the developed nations. In Jammu province, which derives 89 per cent of its power from hydel sources, transmission losses amounted to 62 per cent at the start of the current plan, according to a report of the Comptroller and Auditor-General of India (Tikku 1982).

There are serious regional imbalances in the distribution of the hydroelectric power generated. Often the least to benefit are the people of the regions where the dams are located. In Himachal Pradesh, 85 per cent of whose hydel potential has already been tapped, the per capita annual consumption of electricity is only 56.6 kwh, less than half the national average of 130.5 kwh. In Punjab, the main beneficiary of Himachal's dams, the per capita consumption of 314 kwh is the highest in the nation (CMIE 1981: Tables 5.1 and 5.10).

Flood control

Dams, by impounding a river's water which is released at a controlled rate, act as a buffer against floods. The National Flood Control Programme launched in 1954 has, in addition, constructed embankments, drainage channels and town and village protection schemes. By 1979, Rs 975 crores had been spent on these schemes. In gross terms, the flood control programme has been a failure since the area affected and the economic damage has increased sharply and considerably in the last three decades (Table 2).

Heavy siltation has substantially reduced the storage capacity and the lifespan of many resevoirs, including those of important multipurpose projects. Siltation data (Table 3) shows that the rates originally forecast were substantially lower than those actually observed. As a result, reservoirs are incapable of absorbing heavy floods and have to resort to panic discharges, leading to destructive flash floods in the valleys downstream. The disastrous floods in Punjab in 1978, when 65,000 persons

were rendered homeless, are an obvious example.

Table 2

Damage caused by floods, 1953 to 1981

Year	Cropped area affected (lakh hectares)	Total damage (million rupees) At current prices	At 1952-53 prices
1953	9.3	540	520
1954	26.5	580	590
1955	54.0	1190	1340
1956	21.0	510	510
1957	4.5	240	220
1958	14.9	510	460
1959	15.4	790	680
1960	26.5	670	550
1961	18.3	320	260
1962	35.6	930	750
1963	19.7	380	300
1964	24.7	670	450
1965	2.5	60	30
1966	16.1	650	340
1967	33.0	1370	620
1968	26.9	2030	950
1969	43.4	3330	1490
1970	48.5	2870	1210
1971	62.4	6320	2630
1972	24.4	1580	630
1973	76.0	5690	1790
1974	33.0	5690	1400
1975	38.5	4710	1190
1976	76.8	8890	2390
1977	82.5	12000	2820
1978	100.5	14550	3420
1879	20.0	5970	1400
1980	54.1	8300	1950
1981 (as on 19 August)	16.2	2050	480

Sources: (a) Report of the National Commission on Floods, Vol. 1. Department of irrigation, New Delhi, 1980; (b) Replies to Rajya Sabha Unstarred Questions 109 (17 November 1980), 1906 (11 March 1981) and 836 (26 August 1981).

Table 3: Annual rates of siltation in selected reservoire (in acre feet)

Reservoir	Assumed rate	Observed rate
Bhakra	23,000	33,000
Maithon	684	5,980
Mavurakhsi	538	2,000
Nizamsagar	530	8,725
Panchet	1,982	9,533
Ramganga	1,089	4,366
Tungabhadra	9,796	41,058
Ukai	7,448	21,758

Source: Report of the Irrigation Commission.

Many of the shortfalls in the intended benefits from dams can thus be traced to the neglect of a number of significant details, such as the proper construction of irrigation canals, distribution losses in power lines and deforestation in the catchment areas.

Adverse impact of big dams

The design and construction of dams in India have been conducted mainly as civil engineering tasks, neglecting their harmful ecological impact. Engineers concentrate on providing the intended benefits to downstream areas. Consequently the environment of the catchment regions upstream has been neglected or wantonly exploited in most cases. Although tbis ecological ruin has grave long-range economic consequences for the nation, its immediate victims are the tribals, the peasants in the river valley and the hillfolk, whose lives depend on the resources provided by their immediate environment.

Destruction of habitat

The construction of several large dams has involved the eviction of thousands of families and their resettlement at some other site. People uprooted by large projects, like the Srisailam dam in Andhra Pradesh, the Kali hydroeletric scheme in Karnataka, the Pong dam in Himachal Pradesh and the Sabarnarekha in Chotanagpur, to mention a few examples, have been made refugees in their own land. The Government's

rehabilitation programmes generally offer inadequate financial compensation. They fail to preserve and create the community life of the displaced populations. Instead, the latter are treated as a collection of unrelated individuals in true bureaucratic fashion.

The most glaring example of disregard for the lifestyle of the ousted persons, has been the attempt to resettle evacuees from the Pong dam area in Himachal Pradesh, a hill state, in Ganganagar district of Rajasthan. The latter is a border district, at the edge of the Rajasthan desert. Though many of the refugees were given lands irrigated by canals, they soon sold them and returned to Himachal.

A potentially explosive situation exists in tribal areas like the north-eastern hill states and Chotanagpur. The people here have a tradition of rebellion and armed insurgency. The current thinking in Government circles is to tap the hydel resources of the Brahmaputra river system in the north-east, in a big way. If this causes large scale displacement of unwilling people, it could aggravate the discontent already present in this region, with serious political repercussions.

Case study 1: damming the tribals

The construction of dams has effectively resulted in a direct assault on the country's tribal population. Dams are usually constructed in remote, forest areas where most tribal groups also live. The sudden influx of the modern system, destruction of the surrounding nature on which their lives are dependent, and ultimately displacement and resettlement, leave a tradition-bound tribal family totally bewildered, powerless and on the verge of total social, cultural and economic collapse.

For the 7770 tribal families which are going to be displaced by the multipurpose dams being built across the river Indravati in Orissa, the future has become a big question mark. The Indravati dams will submerge some 99 tribal villages and the people living in these villages are obviously afraid that they will be treated with equal disdain.

A case study of the already displaced village Patradora (which lies closest to the project site) carried out by Chittaranjan Mohapatra and Dr N. K. Bewara of the Department

of Anthropology at the Utkal University, shows the lack of vision with which the resettlement work is being carried out. Patradora consists of 23 Penga and one Dom household. This village was earlier situated adjacent to the main dam site. When the villagers complained that the blasting operations were affecting them, the project authorities decided to shift the village temporarily. In 1980, the villagers were resettled 200 yards away from the old site. They have been allotted new houses at the cost of the project. The old settlement pattern of the village has been retained and facilities have been provided in a way to reduce inconvenience. The dam contractor had also given the villagers priority for jobs as labourers and supervisors.

It is still very difficult to find out whether the villagers were resettled by force, or by friendly persuasion. Blasting work on the river bank had so terrorised them that they had no alternative but to accept the dictates of the contractor. Farming members of the village still find it difficult to move about during working hours because of the blasting operations. A fear psychosis constantly haunts them. They cannot go out and return any time.

Although the old village pattern has been retained, the village priest is not happy with the new settlement because his social position as the supreme religious authority has been vitiated. Since many villagers now work as wage earners on the dam site, and because of the discontent of the village priest, the villagers now apprehend natural calamities and havoc in the future. For proper appeasement of village deities, the Jani (village priest) must be of healthy mind. Rituals are not being performed properly. The villagers also do not want the Jani to work on the dam site as evil spirits may enter his body and affect all the villagers as it is the Jani who controls the deities. For this reason the Jani does not work on the dam.

There are several apprehensions about the resettlement programme. The villagers here know that they will be given land for resettlement and cultivation. But they are not very sure of the type of land and area. Their anxieties increase when they see existing valuable pieces of land which they will lose. Loan sharks have already begun to recover loans from the tribals, even though their actual displacement

may be 20 to 30 years away—especially if the project is delayed, like most dams in India.

Most of the Pengas—whose socio-economic status is low even amongst most tribal groups—have traditionally depended upon shifting cultivation for their subsistence and land is meagre. However, the forests supplement their needs in many ways. The Pengas are avid collectors of roots, tubers, fruits and wild greens; Kuna, a local tuber, is often used by them as a staple during the lean season. The Pengas are not sure if they will have access to a suitable forest, if at all, when they are rehabilitated

The strong attachment to the parental lands has created in the tribals a group feeling which has now become virtually sacred because of ancestral warfare. The displacement will thus amount to sacrilege and the tribals fear that this could shatter their social life. Earlier, they used to perform *ad hoc* rituals before the establishment of a new village and, only If omens were good, the site on which the ritual was performed was selected for settlement. But this will not be permitted in the case of the resettlement sites. The villagers are also anxious about how they will be able to take their deities to the resettlement areas along with them.

The lack of communication between the people to be displaced and the dam authorities has further aggravated these anxieties. The tribals are looked down upon by the officials, who believe that they can manipulate them in any manner they like. Few attempts have bcen made to discuss and convey information to the local people. In the absence of this communication the tribals' own leaders often begin to prey upon their fears. Cases have been found where they spread horror stories to serve their own vested interests. Funds are raised on various pretexts which go straight into their pockets. Meanwhile, many villagers don't even really know what is the purpose of the dam.

Dam diseases

Another harmful impact of dam building on the people is the increase in the incidence of some diseases. The construction of large reservoirs can elevate the sub-soil water in the vicinity with consequent changes in the levels of calcium and

trace metals. This changes the nature of fluorosis, a crippling bone disease, in areas where it is already prevalent.

Irrigation reservoirs generally cover a large area with shallow weed-infested edges. The latter provide breeding grounds for disease carrying mosquitoes. Malaria occurs commonly among construction labourers and among the local population later, unless special precautions are taken. Filariasis and Japanese encephalitis may also appear and become endemic in such areas. 'The Raichur district of Karnataka state has become highly endemic for malaria after Tungabhadra's damming and canal network development,' says Dr V. Ramalingaswami, Director General of the Indian Council of Medical Research (Rao 1981: 92).

Case study 2: the crippling cost of big dams

For all those who believe that nature takes its revenge when disturbed by gigantic artefacts, the curious happenings around the Nagarjunasagar dam in Andhra Pradesh will reaffirm their belief. Water seepage from the dam's reservoir and canals has increased the level of the sub-soil water. The increased soil alkalinity has created an imbalance of trace metals (such as copper, malybdenum, zinc and magnesium) and fluorides in the soil. The sub-soil environmental changes caused by the construction of the dam have triggered off causative factors resulting ultimately in a crippling syndrome of knock knees (*genu valgum*) among the poverty-stricken villagers living in the command area of the dam.

Genu valgum can be identified in the people there, both in standing position and when they walk. In extreme cases, the legs are so distorted that the knee joints cross over. In some others, in the standing position the two feet are separated by over a yard while the knees touch each other. In other cases, an S-shaped deformity of the legs has resulted in a total incapacity to move.

Apart from the severe physical handicap it has imposed, *genu valgum* has also contributed to serious emotional disturbances and social stress. There are several instances of broken families as a result of married women developing the disease. Affected victims are targets of ridicule, insult and social

deprivation. Economic hardship has also visited the affected young men who have been forced to accept lowly paid unskilled occupations, having lost their technical occupation. Not merely individuals but the entire community has suffered in the villages studied by scientists from the National Institute of Nutrition (NIN) at Hyderabad.

A detailed examination of the diets of those affected by *genu valgum* shows that the problem is less frequent among people whose staple food is rice in comparison with those who eat mainly sorghum. Since the lowest socio-economic strata take sorghum as their staple, rice being costly, the incidence of *genu valgum* is higher among the poorest groups of the village population.

Further studies conducted by the NIN have shown that the problem of severe knock-knees has also emerged in fluorotic areas in Karnataka and Tamil Nadu where new irrigation dams have been built. *Genu valgum* cases have been found in villages in Coimbatore district situated within a radius of 30 Km from the Parambikulam-Aliyar dam. Similarly, *genu valgum* cases have been reported from villages near the Hospet dam in Karnataka.

Deforestation

The decimation of vital forests in the catchment areas is one of the most serious consequences of the engineering approach. Large tracts of forests have been lost as a result, particularly in the Himalayan hills and the Western Ghats. Submerging forest lands has aggravated the problem.

Rapid deforestation in the catchment areas leading to increased soil erosion, landslides and consequently heavier water flows into the reservoirs, imperils river valley projects in the Himalayan, Weste.n Ghat and Chotanagpur regions. Analysing the threat to the massive Tehri dam, Dr S.P. Nautiyal, a former Director-General of the Geological Survey of India, says: 'The Bhagirathi and the Bhilangana rivers drain the southern slopes of the central snow-covered Himalayas, where erosion is extraordinarily active and the river brings silt for eight months in the year. The hill sides of the catchment area have been denuded of vegetation leading to heavy erosion. The proposed life of the Tehri reservoir may turn

out to be only 30-40 years instead of 100 years' (D'Monte 1981).

The ecological damage done by construction of dams was brought into sharp focus by the campaign against the Silent Valley Hydro-electric Project in Kerala, 'ed by the Kerala Sastra Sahitya Parishad. Silent Valley is a tropical rain forest area at the southern end of the Western Ghats. The specific issue here is the threat of extinction posed by the dam to the tremendous variety of biological species that have evolved over hundreds of millions of years.

Case study 3: the seven per cent solution

The Silent Valley controversy presents a classic case study in the environment versus development debate.

A plan to generate hydropower by damming the Kuntipuzha river flowing through this valley was first considered in 1921. A drop of 857 metres, the highest in the state, makes it an ideal site for a hydel project. Unfortunately it also happens to be one of the few tropical rain forests in the country left undisturbed by the onslaught of modernisation. With an evolutionary age of more than 50 million years, the Silent Valley has one of the richest biological and genetic heritages in the world.

Malabar—the region where the Silent Valley is located—is one of the least developed areas of Kerala. The per capita consumption of electrical energy in Malabar is only a quarter of the statewide figure. Many people in this area have been campaigning for the project in the hope that it will provide employment.

A preliminary study of the peripheral areas of the valley has yielded information on over 900 species of flowering plants and ferns. Several specimens that have become extinct elsewhere are found in the Silent Valley, according to the Botanical Survey of India. A few plants collected by it are new to science. The vegetation abounds in medicinal and aromatic plants as also wild relatives of spice and pulse yieding plants. The latter have shown an enormous amount of genetic diversity with respect to disease resistance and protein content. The plant genetic diversity is an immense economic resource that

the Royal Commission of Agriculture in India had stated: 'It would appear that many of the troubles which have arisen in irrigated tracts of India in regard to waterlogging and formation of salty land have been due to failure to properly correlate a new irrigation system with the natural drainage of the tract.' The Commission recommended drainage construction in all new irrigation projects. In 1982, our scientists and officials are still pointing out the same.

Case study 4: Mitti Bachao and Tawa dam

Dry land plus irrigation equals luxuriant crops and prosperity for the farmer—this belief dictated the policy of building large irrigation projects. But recent studies have shown that more often than not such large irrigation projects reduce the fertility of the soil by causing waterlogging and salinity and subsequently decrease in crop production.

This has been the experience of the over one lakh farmers of Hoshangabad district in Madhya Pradesh, the supposed beneficiaries of the Rs. 91.42 crore Tawa dam, which is a part of the Rs. 300 crore integrated irrigation scheme on the Narmada river. A dam is being built on the confluence of the Tawa, major tributary of the Narmada and the Denva, another tributary.

The farmers of the area launched a unique Save the Soil Campaign—Mitti Bachao Abhiyan—in August 1977; their longstanding experience of cultivating the water retentive black cotton soil told them that the canal and the irrigation project would spell disaster for the area. Water seepage in such soil was foreseen but its extent was underestimated. Project authorities thought it would be only 30 per cent through the unlined canals; later surveys showed that it was as much as 60 per cent. The most productive areas before the advent of irrigation have now been affected by water seepage.

Traditionally the one lakh farmers of the region practised dry farming. The water table is fairly high and therefore suited to tubewell irrigation. The district also has a high average rainfall—1303 mm. In the *kharif* season the farmers grew jowar, sesame and cotton and in the *rabi* wheat. This crop rotation plus compost and manure met the deficiencies in the

soil.

With canal water flooding the fields, traditional varieties of wheat cannot grow any more; also pulses and sesame have gone out of production. They have been replaced by soyabean which is supplied to a nearby factory for soyabean-based products. But the change in crop patterns is also replacing self-sufficiency with dependence. Soyabean has to be harvested at short intervals; instead of doing this themselves the farmers have begun to hire tribal labour from neighbouring villages. Seed banks provide the high-yielding seeds but these varieties also require fertiliser and pesticides. The margin of profit on soyabean is many times lower than what the farmers earned from pulses.

Further, recent surveys have shown a clear drop in the productivity of the irrigated waterlogged soil. According to the report of the Auditor-General of India (1979-80) on the Tawa project, whereas paddy production before irrigation was averaging four quintals per acre, after irrigation it has dropped to 3.88 quintals. A similar perceptible drop is seen in the production of jowar, maize, wheat and gram. The Auditor-General concluded in his report that 'the project was ill-conceived and benefits that were presumed would be available could not have been realised.' He suggested a second look at the programme.

This much needed second look has not yet been forthcoming. The Mitti Bachao campaign continues.

Earthquakes and dam bursts

Dams can also create several hazards which are very significant but not so well-known. Scientific research conducted at several large reservoirs has revealed the possibilities of earthquakes being triggered due to the impounding of massive amounts of water in them.

The reality of these hazards was highlighted after the devastating earthquake which struck Koynanagar, 450 km southeast of Bombay on December 18, 1967. This region had long been a non-seismic one, but had experienced a series of tremors after the impounding of water in the Koyna dam reservoir in 1962. In the 1967 earthquake, nearly 200 lives

were lost, 1500 people were injured and thousands were rendered homeless. More than 80 per cent of the houses in Koynanagar were either completely destroyed or became uninhabitable. The tremors were felt in faraway Bombay.

Dams can be designed to resist collapse during earthquakes. A more sensible approach is to thoroughly investigate a site, where a large dam is to be constructed, for potential earthquake hazards, as part of the environmental impact analysis. The need for caution is especially great in regions that are known to be geologically unstable, such as the Garhwal Himalayas. The Tehri dam which is being constructed here, and which will be the fifth highest rock-filled dam in the world, has been criticised as being a potential time bomb.

There are also cases of bad designing and poor quality construction leading to dam bursts. The worst dam disaster in India was the bursting of the Machu dam in Gujarat in 1979. Several hundred people were killed and the town of Morvi, along with several villages, was destroyed by the flood waters.

Cost benefit analysis

India has spent about 14 per cent of its total plan expenditure on dams and canals. The Planning Commission's criterion for approving dam projects is that the cost-benefit ratio should be at least 1:1.5. The preceding sections have shown clearly that in most cases, the benefits fall short of the intended targets while the costs escalate. At a high level meeting convened recently by the Planning Commission, to which voluntary organisations were also invited, it was observed that the feasibility reports submitted to it for approval often contained estimates that oversatisfied the criterion. Obviously the sole purpose of this tactic was to win the Planning Commission's approval.

An independent review of the Bhima Project in Maharashtra, concluded that by the time all the project expenses had been incurred, the benefit/cost ratio had been reduced from 6.29 to 0.9. However, if the special cost of rehabilitation and damage to the environment were also quantified—the ratio would fall to as low as 0.46:1. (Paranjapye 1981: 21-39).

Alternatives

To point out the various hazards and environmentally harmful impact of dams does not imply recommending a ban on all such projects. It simply draws attention to human and environmental concerns that have been ignored so far. Various authorities have stressed that dams are essential for meeting the developmental needs for irrigation and power. But development without destruction is possible. The first step is obviously to make this a guiding principle in the planning and design of such projects.

The second step is to achieve a fuller utilisation of the benefits of the dams that have already been built. This requires greater attention to delivery systems. The cheapest form of alternate energy is energy saved,' says the Sixth Plan document. Reduction in the tranmission and distribution losses of power can significantly increase the availability of power. These losses at present amount to over 40 per cent of installed capacity, nearly 5000 MW, that will be added during the Sixth Plan. Quick construction of canals and lining them properly increase crop yields from the command areas of irrigation projects.

The third step is to seriously look for alternatives to gigantic projects. Groundwater resources development offers a number of environmental and economic advantages over major irrigation schemes. Small scale hydroelectric plants can be very useful in augmenting the country's available hydroelectric potential and in providing electricity in remote areas, particularly the hill districts.

A survey of India's hydel resources, by the Central Electricity Authority, estimated the small hydroelectricity potential of India at 25 billion kwh. which is about 60 per cent of our present installed capacity. Indian planners, however, have so far shown disdain for small hydel schemes. By contrast. in China, 87,000 small hydel works generate almost a third of its total hydropower (Damodaran 1981: 58). But these units can only serve the nearby rural populations. Micro hydel schemes, therefore, run counter to the current trend of large centralised projects, the lion's share of whose output is fed to urban based industries. This is perhaps the real reason why small hydro-

celectric projects have not been taken up in India.

Why have the social and environmental costs of large dams been ignored so far? One reason is that our planners and engineers are mainly rooted in urban India. Their lives are far removed from a direct dependence on natural resources. The negative impact of such projects is mostly borne by tribals, peasants and the hill folk, whose daily lives depend closely on their immediate environment. Madhav Gadgil, a former National Environment Fellow, suggests that the interests of these wearker sections of our society should be used to determine whether a project is environmentally sound and whether it will promote a balanced development process. 'If these interests are given serious consideration, we will orient ourselves towards planning . . . for true, sustainable development' (Gadgil 1981: 1-13).

5

Pesticides and the Third World Poor

David Bull

'Pesticides are often mixed by hand and sometimes pesticide powders are just sprinkled by hand onto the crops,' says Mr. S Selliah (1980), Asian representative of the International Federation of Plantation, Agricultural and Allied Workers. A survey carried out among farm workers in Gujarat has often been quoted in the Indian Press (Anon 1980). It confirms the lack of safety precautions in the use of pesticides in India. None of the workers engaged in spraying were provided with face masks, they only half covered their face with a cloth and 20 per cent failed to wash after working with pesticides. A trade unionist in Karnataka reported (Singham 1980) that his members were not provided with any protective clothing when using pesticides. If organised plantation workers are unable to follow safety precautions, or are unaware of the need for such precautions, consider how much worse is the position of the poor cultivator or the casual labourer.

It might be argued that farm workers fail to take their responsibilities seriously and that it is their own fault if they do not take proper safety precautions. This argument though, fails to take account of the difficulties faced by pesticide users in the Third World. Small farmers or poor farm workers can only take the necessary precautions if they are aware of them and if they are realistic and feasible. All too often these conditions do not occur. Advertisements and labels on packets of pesticides are inadequate or misleading and sometimes not in the language of the user. The user is probably

unable to read and understand complex instructions in any language. Even if the instructions are properly understood, they may be impossible to follow. Face-masks, respirators, overalls, rubber gloves and boots are likely to be unavailable in the village store, or beyond users' financial reach.

Yet many pesticides freely available in numerous Third World countries require the use of some of these protective devices. However, some items of protective clothing, even if they are available, are impossible to wear under tropical conditions without serious discomfort. Even apparently simple instructions such as 'wash with soap and water' can prove difficult to follow for poor people under Third World conditions. In the event of an accident, health professionals are not within easy reach and in any case may not be trained to recognise and treat pesticide poisoning and may lack access tc the drugs needed to help the sufferer.

Economic and social development sufficient to substantially improve the conditions under which the poorest people must live and work will certainly not happen overnight. In the meantime, pesticide use is increasing rapidly and the more hazardous pesticides represent a dangerously inappropriate technology. Under these circumstances it is essential that the production, distribution, marketing, labelling, packaging and use of pesticides, are carried out only in accord with the very highest standards.

Whilst it would be reasonable to ask for higher standards in Third World countries (because of the conditions under which pesticides are used) than those applied in Europe or America, the reality appears to be exactly the opposite. Many Third World governments fail to implement effective pesticide registration or control due to lack of resources or of political will, while the rich pesticide exporting countries exercise little or no control over the export of hazardous pesticides. The result is that many pesticides which are restricted on safety grounds in their countries of origin are freely exported to relatively unregulated Third World markets. Labels are often inadequate or not in the language of the user, while advertisements help to create and perpetuate the myth that pesticides represent safe panaceas for farmers' problems. The inevitable result of this combination of inadequate standards, ineffective

regulation and hopelessly unsafe use conditions is massive poisoning incidence and impending agricultural crisis.

International Trade

The Third World accounts for about 15-20 per cent of the world's pesticide consumption (Bull 1982a: 6), including about one-third of the insecticides (Patton, Craig and Conway 1980: 58). This amounts to some 100 grammes for each Third World inhabitant and is growing rapidly. Between 1974 and 1977, for example, the value of Third World pesticide imports grew by an average of 15 per cent per annum (UNO 1978a: 312). The vast majority of pesticides are manufactured in the rich world (Weir and Schapiro 1981: 6) although some Third World countries such as India and Brazil, are producing a significant proportion of their own requirements. In 1980-81, India produced some 43, 000 tonnes of pesticides and she consumes nearly 80,000 tonnes per year (Chakravorty 1981). Despite producing about 50 per cent of her own requirements, Indian production has been falling behind consumption, leading to a trend of increasing imports. Imports by value have risen from Rs. 3.9 million in 1978 to Rs. 8.4 million in 1979 and dramatically to Rs. 29.5 m in 1980 (Ibid: table 4). Despite her local production then, India is dependent on imports, particularly from Europe and North America. For most Third World countries such imports represent virtually their sole source of pesticide active ingredients. The world's major pesticide exporters are the USA (accounting for 16.5 per cent of world exports in 1978) and the European Economic Community (accounting for 61.5%). The latter includes the UK (12.2%) (UNO 1978a).

Many of the pesticides exported from Europe and the USA are banned or severely restricted in their countries of origin. In 1976, for example, some 30 per cent of US pesticide exports were of products whose use was prohibited in the USA (Peterson and Harris 1981: 7). Britain exports to the Third World at least nine pesticides which are domestically restricted to trained and supervised operators wearing specified protective clothing, as well as at least one pesticide withdrawn from use in the UK and one listed as a poison (Oxfam

1981). The total value of UK pesticide exports to the Third World increased by 211 per cent between 1975 and 1979 (UNO 1978b), yet Britain has no legislation governing the quality, labelling or packaging of pesticides for export and no procedures for exchanging information with importing country governments or for consulting with importing governments prior to the export of banned or restricted products. Similarly no European country has any such legislation. The USA has procedures for information exchange related to the export of pesticides banned or restricted in the USA and rules governing the labelling of pesticides for export (Bull 1982a: 151-153). These regulations are very mild and do not include provisions to prevent an export taking place after consultation with the importing country. An Executive Order by President Carter was signed on 18th January 1981 in an attempt to strengthen these regulations, but this Order was revoked by the incoming President Reagan on 17th February 1981. Even the existing regulations are now under threat of further relaxation following a report to President Reagan by his Secretaries of Commerce and State (Govt. of USA 1982).

The issue of pesticide exports was taken up at the UN General Assembly recently. A resolution proposed by 23 Third World countries (including India) was carried on 8th December 1982. The resolution called for information exchange and consultation between exporting and importing countries, as well as labelling provisions (UNO 1982). The USA, for many years the only country to have adopted such procedures, was in this case the only nation to vote against the UN resolution.

Pesticide poisoning

The availability of some of the most hazardous pesticides under the conditions prevailing in rural areas of the Third World leads inevitably to widespread suffering from accidental and occupational pesticide poisoning. The situation is not helped by the lack of *effective* pesticide control legislation in many countries.

The lack of health infrastructure in most Third World countries makes it difficult to gather acccurate statistics on the

incidence of poisoning. Many minor poisoning incidents are never reported or diagnosed and only the lucky few receive hospital treatment. For these reasons any statistics are likely to be rather conservative.

In 1972, the World Health Organisation estimated a world wide total of 500,000 accidental poisoning cases annually (WHO 1977), 9,200 of them being fatal (Copplestone 1977: 147-155). Allowing for worldwide growth in pesticide use since 1972, the present figures would give 750,000 cases with nearly 14,000 deaths. The Third World, using only 15-20 per cent of the world's pesticides suffers about half of the poisoning cases (375,000) and nearly three-quarters of the deaths (10,000) (Bull 1982a: 37-38).

Such global estimates tend to obscure rather than illuminate the daily reality of widespread poisoning described by rural people and health practitioners. A doctor in the Philippines has reported that he treats up to six people a day for poisoning during peak spraying season. Leila Solorzalo, a nurse in Costa Rica treats two or three cases a day during peak months (Bull 1982b: 10).

In Sri Lanka, some 12,000 people a year are poisoned by pesticides, 1,000 fatally. 25 per cent of these cases are the result of occupational or accidental exposure. A recent report in the WHO Bulletin says that

> It is possible that in other predominantly agricultural countries of the Third World the figures will be equally high. In Sri Lanka in 1978, where over 1,000 deaths were due to pesticide poisoning, there was a total of only 572 deaths due to poliomyelitis, diptheria, tetanus, and whooping cough, and malaria did not result in a single death. In spite of the extent of the problem of pesticide poisoning, it has for a variety of reasons so far, not been highlighted (Jeyaratne. Seneviratne and Copplestone 1982: 615-619).

Occupational and accidental poisoning cases occur in a variety of ways. Farm workers mixing and applying these chemicals or entering fields after spraying are the group most at risk. Other cases include mistaken drinking (often by children) and the re-use of empty pesticide containers for carrying water or for food storage. In all such caes, the common cause is the availability, often with very little effective

restriction or control, of very toxic products in conditions where the necessary safety precautions are highly unrealistic.

The pesticide treadmill

It might be argued that such widespread pesticide poisoning, whilst regrettable, does not justify tight controls on the use of pesticides since such control may adversely affect production, at great cost in money and even lives. Such an analysis, however, fails to perceive the full impact of pesticide misuse in the Third World. Such misuse, as well as creating a serious risk to the health of users, can simultaneously *threaten* agricultural production. The idea that safety and health considerations are essentially in opposition to those of agricultural output, although it may contain an element of truth in certain specific instances, is not accurate for pesticide use in general. In reality, health, safety and productivity are on the same side, each tending to re-inforce the other. The real choice is between pest management practices which lead to bad control *and* devastating side effects, or pest management practices which are both safe and effective. Safety and productivity are both served by restricting pesticide use to the minimum necessary for economic crop protection, by combining chemical control with other methods of pest management, and by using selective and low toxicity products wherever possible. The widespread and often excessive use of highly toxic and broad spectrum chemicals is likely to bring more poisoning cases without the promised increases in agricultural production. Ultimately such a pattern of pesticide use can lead to a crisis of falling yields and rising costs.

Such a crisis of production can arise as a result of the pesticide treadmill—the interaction of natural enemy mortality with the development of pesticide resistance in pest species.

It has been demonstrated experimentally that suitably timed applications of a broad spectrum insecticide can result in dramatic increases in the population of the target pest. One such experiment showed increases of up to 1,250 times (Bach 1974: 2-3). Similar problems occur in the field—the result of the destruction of the parasites and predators which otherwise maintain the pest population to more manageable levels.

Similar damage to naturally occurring beneficial species can also allow the rise to serious pest status of previously unnoticed or relatively minor pest species (known as secondary pest outbreaks).

The history of cotton production in Central America (ICAITI 1977: 27-30) is a classic illustration of these phenomena. Before 1945, farmers were troubled by three pest species, whose populations were kept down by natural enemies, manual and cultúral controls and a low level of pesticide use. During the early 1950s intensive use of machinery and chemicals began, bringing increased yields with some eight pesticide applications a season. By the mid-1950s three new pest species had become serious problems. During the 1960s, pesticide applications reached 28 a season and, whilst two species ceased to be so important, these were replaced by four others, including the whitefly. The increasing number of major pest species and the development of resistance led to ever greater pesticide use until pest control came to account for 50 per cent of cotton production costs. Despite this, yields began to decline. By the early 1970s there were eight important pest species and farmers were spraying 40 times a season.

In other parts of the world, it seems, the same tragic cycle is repeating itself. Entomologist Dr Veeresh (1980) of the Agricultural University in Bangalore predicted in 1980 that 'within 10 years, it will not be surprising if we are in the same position as Latin America.' As long ago as 1976-77 a survey in India found that, for irrigated long staple cottons, on an average plant protection accounted for one-third of cultivation costs (Ramachandran, Joshi and Menon, 1980: 208-209). As 1982 drew to its close the *Times of India* reported that, in Gujarat, cotton farmers are now spraying 20 or 30 times a season and that pesticides account for 50 to 60 per cent of cultivation costs in some districts (Bidwai 1982). In the Vidarbha region of Maharashtra, some farmers are reported to have increased their pesticide consumption fourfold in the last five years. The classic treadmill picture was painted by one farmer (from Wardha) interviewed by the newspaper: 'I'm spending 340 per cent more this year on these chemicals than two years ago,' he said, 'but all that has happened is that the leafworm has vanished . . . but the bullworm . . . has come back with a

vengeance.'

Less pesticide-dependent methods of pest management need to be put into practice urgently if such crises are to be avoided. Such methods, where pesticides are used selectively and judiciously will help to hold off the accelerating development of resistance pest species as well as maintaining natural enemy populations and protecting farm workers from excessive exposure to hazardous chemicals.

The global magnitude of the treadmill problem becomes increasingly apparent as the resistance figures climb: by 1980, 432 species of arthropods (insects, mites, etc.) were resistant to at least one, and often to several, insecticides—an increase from 25 in 1954 and 185 in 1965 (Georghiou and Taylor 1976: 760). The real impact of this resistance can best be demonstrated by looking at some specific examples (FAO 1980).

In the Rio Grande Valley of Mexico, the tobacco budworm, a cotton pest, was once kept under control by natural enemies. It became a serious pest when these were wiped out by pesticides used against other cotton pests. As the budworm developed resistance, more and more pesticides were used. Farm workers often suffered pesticide poisoning, but the budworm went from strength to strength, wiping out crops worth £ 35 million a year in North Eastern Mexico. In 1970, 700,000 acres of cotton land were abandoned: cotton gins went out of business, farm workers moved away in search of work elsewhere and a once prosperous community was plunged into social and economic depression (Bull 1982a: 164).

In the Cameron Highlands of Malaysia, the Diamond Back Moth is now resistant to a wide range of pesticides. Farmers have to spray their cabbage crops three times a week, often with 'cocktails' of different insecticides (Sudderuddin and Pooi-Fong 1978: 53-57). Cabbage growing is rapidly becoming uneconomic and it was predicted in 1980 that within three to five years there would be no further chemical insecticides effective against the Diamond Back Moth (Conway 1980: 78). As long ago as 1978, the situation was described as 'desperate' and insecticides accounted for nearly a third of production costs (Ooi and Sudderuddin 1978).

Pesticide treadmill crises are most worrying when they threaten production of a staple food crop. Professor Conway

(1980) of London's Imperial College has stated that 'the circumstances currently most favouring a crisis in a staple crop occur in rice in East or South-East Asia.' The brown planthopper, now probably Asia's most damaging rice pest, has developed from relative insignificance just 10 years ago, as a result of the changing practices of the Green Revolution combined with the impact of pesticides on natural enemies (Bull 1982a: 13-14). At the same time, the number of rice pests showing insecticide resistance has risen from eight in 1965 to 14 in 1975 (Reynolds 1976: 798).

Labelling and advertising

If pesticides are to be used safely, effectively and only when necessary, then users need to have access to good and usable information. Governments and research institutions have a clear responsibility to provide this through extension services. But perhaps the most critical responsibility rests with the producers and distributors of pesticides. They must label their products fully, clearly and accurately, providing usage instructions, safety precautions and warnings, fiirst aid and medical advice in the local language of the user. The special seriousness of the consequences of pesticide misuse in the social and physical environment of the Third World serve to emphasise this responsibility. Yet just where the need for high standards is the greatest, the reality is very far from satisfactory. It has been reported that a recent check in Mexico found that 50 per cent of pesticides were incorrectly labelled (Weir and Schapiro 1981: 16). A survey of herbicide labels in the Philippines showed that 'many labels did not meet basic information requirements' (Moody et al. 1981: 428-429).

Even where lables are adequate, it is often impossible, especially for poorer farmers and farm labourers, to put label instructions into practice. Firstly, high rates of illiteracy prevent the spread of accurate information. Even where labels can be understood they cannot necessarily be obeyed. In a remote part of rural India, for example, even simple instructions to 'call a doctor immediately' or to 'wash with soap and water' often represent no more than wishful thinking. How much more difficult is the instruction to wear a respirator, a face mask, or even rubber gloves.

There is no doubt that labelling can and should be improved and geared specifically to Third World conditions. The discussion on labelling confirms, however, that the availability of the most hazardous pesticides is, in many parts of the Third World, incompatible with local conditions. If these pesticides are available it is important that users should be aware, as far as possible, of the conditions necessary for safe use before they decide to purchase the product. For this reason, it is critical that advertising and promotion should be of the highest possible standards. Unfortunately, advertising standards in the Third World are far from satisfactory and often downright misleading. Safety warnings are often missing or inadequate and in some case positive claims of safety are made for hazardous products. Some advertisements make impossible guarantees of high profits or good harvests and often dangerous chemicals are presented as panaceas for the problems of the Third World farmer.

A selection of examples from India will serve to illustrate this problem. A promotional leaflet for Anthio (formothion) by the Swiss company Sandoz includes on its front cover the phrase: 'GREATER SAFETY: Less toxic to human beings.' Greater safety than what, one may ask—but no answer is given and the impression of safety given on the cover is contradicted by the small print, which says: wear protective gloves and face-mask when handling the concentrate.' A leaflet on Difolatan (captafol—marketed by Rallis India Ltd., in collaboration with Chevron Chemical Company, USA) states that Difolatan is 'safe.' Although captafol is unlikely to present acute hazards in normal use, no pesticide can be accurately described as 'safe,' and indeed later in the same leaflet one finds a list of precautions and medical advice including the information that the product 'may cause irritation of eyes, nose, throat or skin.' Similarly, Du Pont's fungicide Benlate (benomyl—marketed by Agromore) is described in a leaflet as 'safe to handle.'

It is disappointing to find that such misleading promotional statements are produced not only for the products of companies with rich world connections, but also by Indian government enterprises which, one would hope, would set an example of responsible practice. On a visit to India in 1980,

I found, for example, a leaflet for Hildan (endosulfan) produced by Hindustan Insecticides Limited (A Government of India Enterprise). This leafet states Hildan is 'relatively safe to men and animals' and is 'relatively safe to handle,' yet endosulfan is restricted by health and safety regulations in the UK because of its relatively *high* acute toxicity. The WHO/FAO Data Sheet on endosulfan quotes a minimum cautionary label statement: 'Endosulan is a toxic substance and may cause convulsions. It is poisonous if swallowed. It may be absorbed through the skin...' (WHO/FAO 1975: 8). It is clear that there is scope for the pesticide industry to improve labelling and marketing practices in the Third Wold.

Solutions

This paper described a number of very serious problems both for health and for agriculture, which result from the indiscriminate marketing and use of pesticides in the Third World. It is important also to include some suggestions for improving the situation. Briefly there are two types of solutions: technical and regulatory.

The technical solutions require the wider use of less pesticide dependent pest mangement strategies, particularly those which fall under the title of 'Integrated Pest Management' or 'IPM.' Ideally IPM represents an approach which draws upon a number of different pest management methods including the careful, selective and limited use of pesticides alongside biological and cultural controls, physical controls, the use of pest resistant plant varieties and other techniques. The objective is to maintain pest populations below the 'economic damage threshold' (below which the cost of control measures is greater than the value of crops lost), i.e., not to eradicate the pest, but to keep its population within tolerable bounds. This allows a farmer to avoid the expense (and hazard) of spraying when pests are not present in significant numbers. It also protects beneficial species and reduces selection pressure for resistance and is cheaper and safer than routine prophylactic spraying.

IPM can be a complex system and if it is to appeal to small Third World farmers, must be kept as simple as possible

and rooted in traditional practices understood by the farmers. It should not become another highly technical, Western-devised system imposed upon Third World farmers without their participation and understanding. Nevertheless the insights it offers appear to be the only technical way out of current pesticide-related problem.

Some experimental IPM projects for rice are being carried out in India (Kulshreshta 1976) involving farmers and training them 'so that they become self-reliant in the use of the technology rather than depending on experts.' The 1979 report of one such project describes its success in reducing the number of insecticide applications from 4-6 down to just 2 per crop (Anon 1976; OECD 1977: 63-68)

Unfortunately the wider development of IPM is constrained by lack of expertise and funds as well as by the pervasive belief in the promise of pesticides as a panacea and by the habit-forming influence of the pesticide treadmill. Those who suffer the ill-effects of pesticide-dependence in terms of poisoning, rising costs and agricultural crisis cannot wait for the technical solution of IPM for some relief for their problems. More immediate regulatory solutions need to be sought in order to prevent the worst abuses of current practice and to create a climate in which the technical solutions can more fruitfully develop. This implies effective legislative control on the import, availability, labelling and marketing of pesticides by Third World governments as well as the setting of internationally accepted standards through the United Nations system. In addition, the pesticide exporting countries of Europe and America should recognise their responsibility to ensure proper labelling and quality of pesticides for export, as well as to share information with Third World governments and pesticide users and to consult with importing country governments in order to control the export of hazardous, domestically banned or restricted products.

Unfortunately, although some progress is being made, there is still a long way to go in this field. FAO pesticides officer A.V. Adam wrote in 1976 that 40 per cent of developing countries were estimated to have no specific pesticide control legislation and added the important rider that 'even where they do, individual schemes are inadequate' (Adam

1976: 126). Among the exporting countries, only the USA has adopted formal information exchange procedures and even these are inadequate and, as we have seen, under threat of further emasculation.

Under the auspices of the FAO, a code of conduct on pesticides is in preparation, but again there is a long way to go. Even if the final code is strong and comprehensive, it will be up to companies and governments to put its standards into practice.

The Pesticides Action Network, a worldwide coalition of non-governmental organisations, is at work in all these spheres and is pushing for positive changes for the benefit of the Third World poor. It is important that Third World governments also put their weight behind such proposals. However, if their views on international fora are to be taken seriously and acted upon by the countries of the rich North, it is important for Third World governments to be seen to be making some progress in putting their own houses in order, through improved legislation and control on the availability and use of pesticides, whether imported or locally manufactured.

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Index

Afforestation, 28, 41
Agriculture, 3, 19, 56, 57, 68, 85

Conservation, 2, 31, 40, 50, 54; of animals, 2; board, 54; of nature, 40; soil, 12, 15, 22, 29, 50; water, 15, 16, 22, 29, 31; *see* also forest, wildlife

Dam, 53, 56, 57, 59, 61, 63-67, 69-73; big (large), 65, 72, 74; building, 56, 64; burst, 71, 72; disease, 64; irrigation, 56, 66; multipurpose, 62; site, 63, 64, 72
Deforestation, 3, 7, 13, 16, 19, 22, 41, 56, 57, 61, 66
Development, 1-3, 5, 6, 9, 15, 67, 73; approach, 1, 5; economic, 7, 6; pattern, 4; (of) resistance, 80, 81, 82; social, 2, 76

Ecological, 4, 15, 46, 61; balance, 41; benefits, 5, 29, damage, 67, imbalance, 6
Environment, 61, 67, 72, 74, 83; deterioration of, 3, 4, 5; protection of, 3; *see* also forest
Environmental, 2, 5, 6, 23, 36, 50, 53, 65, 73; consequences (implications), 1, 15, 33; costs, 6, 74; deterioration (degradation) 2, 3, 5, 6, 9, 56; equilibrium, 47; management, 53; needs, 4, 5; policy, 5; stability, 46

Erosion, 15, 66; soil, 12, 13, 15, 16, 51

Forest, 2-4, 7, 9, 10, 12-15, 17-21, 23, 24, 28, 29, 31-35, 37-39, 41, 45, 48, 53-55, 64, 66; area, 4, 17, 30, 36, 39, 40, 50, 54, 62, 67; belt, 25; conservation (act); 11, 38, 46; corporation, 20, 32, 34; cover, 13, 15, 17-19, 22, 27, 31, 32, 35, 41, 45, 51, 53; deciduous, 10, 48, 53; degraded, 28, 32, 33, 35, 37, 54; department, 7, 8, 20, 22, 26, 32, 35, 46, 50, 53, 54; division, 24, 25; dweller, 3, 4, 7, 55; ecosystem, 21, 47, 48, 50; environment, 13; evergreen, 12, 13, 15, 21, 23, 26, 48, 51-53; exploitation of, 4, 38, 39, 47, 50, 51; function of, 12, 13, 48; (based) industry, 23, 24, 27, 39, 45; labourers, 29, 39; land, 28, 30, 32, 35, 37, 40 45, 46, 52, 66; management of, 4, 18, 19, 20, 39, 46; miscellaneous, 33, 34; monoculture, 2, 51, 53; natural, 10, 13, 25, 26, 54; policy, 4, 5, 11, 21, 40, 41, 45; produce, 3, 4, 13, 29, 32, 39, 46; rain, 24, 25, 67; and raw materials, 2, 3, 11, 13, 23, 24, 36, 37; reserve, 20, 36, resources, 16-19, 31, 38, 39, 53; (and) revenue, 2-4; stock,

18, 30, 32; tropical, 12, 13, 21, 26, 47, 48, 50, 53, 67; wealth, 39, 40, 46, 54
Forestry, 7, 10, 11, 45, 54; board, 45, 46; commission, 17; community, 8; farm, 26, 27; production, 11, 22; sector, 31, 32; social, 7, 8, 26, 27, 36

Insecticide, 5, 80, 82, 84; application, 86; chemical (synthetic), 5, 82; resistance, 83, 85

Labourer, 29, 39, 63; casual, 75; farm, 83; landless, 5, 32

Pesticides, 4, 6, 7, 12, 71, 75-77, 79, 81-87; advertisement for, 75, 76, 84, 85; chemical, 6, 81; consumption of, 77, 81; control of, 76, 78, 80, 86, 87; export of, 76-78, 86; hazardous, 76, 78, 84, 86; import of, 77; (labelling) on, 75, 76, 82-86; misuse of, 80, 83; packet (container), 75, 79; poisoning, 76, 78-80, 82, 86; registration of, 76; treadmill, 80-82, 85; use of, 76, 79-81, 84, 87; use of, 75, 76, 80, 83-86

Resource, 12, 16, 18, 19, 25, 30, 31, 34, 39, 52, 54, 61, 76; cost of, 30; critical, 23; human, 6, 31; natural, 2, 13, 74; non-renewable, 4, 9; renewable; 2, 4, 18, 23; use of, 38, 39; water, 32, 73; *see* also forest

Tribal, 4, 5, 13, 25, 32, 34, 46, 47, 53, 61-64; area (tract) 28, 36, 40, 62, 74; economy, 13, 15; group, 62, 64; labour, 71; medicine 12; society, 36

Wildlife, 2, 21; conservation, 21; reserve (sanctuary), 2, 21, 25, 40

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